DECEMBER 1960

Precision Metal Molding

INCLUDING DIE CASTINGS MAGAZINE

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P12

AN INDUSTRIAL PUBLISHING CORPORATION MAGAZINE

PMM

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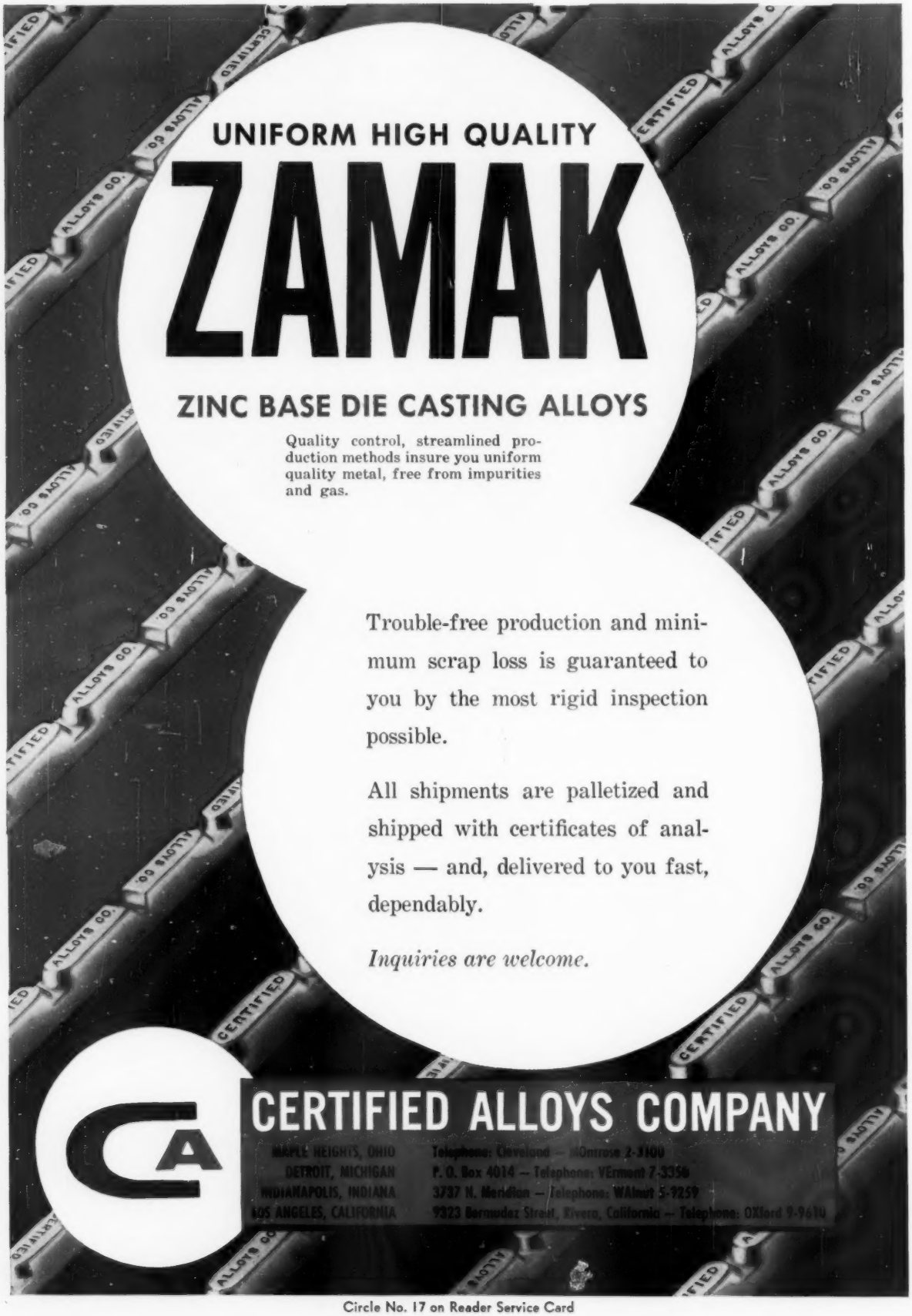
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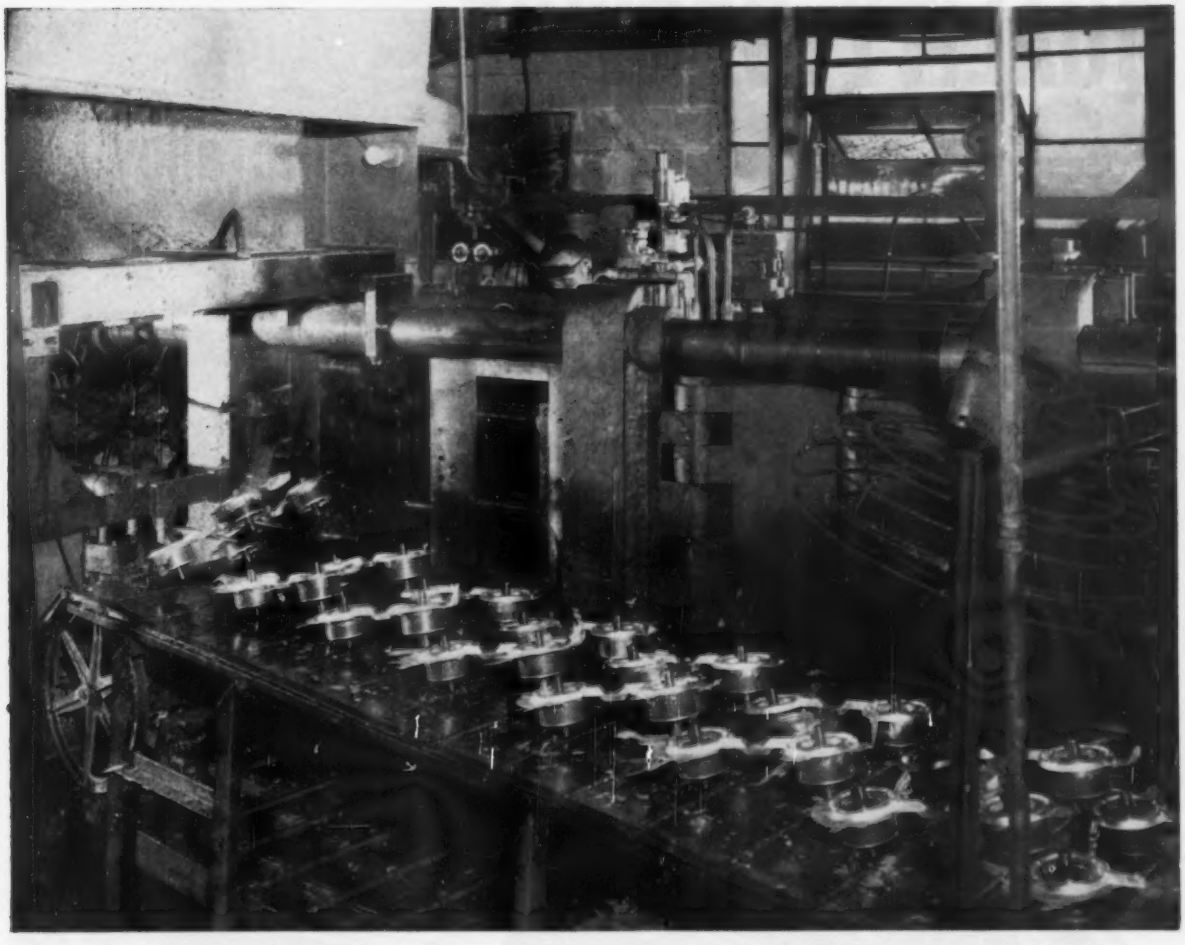

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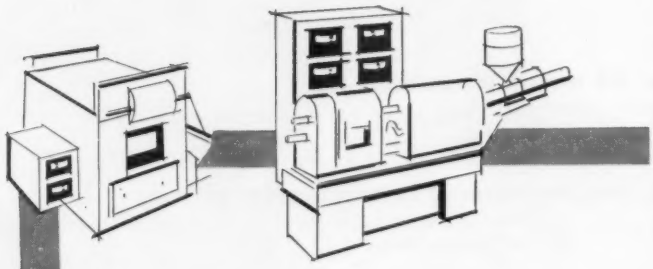
Why it pays to see that

WEST Instruments are in

Original Equipment

using Temperature Control



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Ronald Khol . . . . . *assistant editor*
Robert K. Mueller . . . . *assistant editor*
Scholer Bangs . . . . . *western editor*
672 So. Lafayette Park Pl.
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New York 17, N. Y.
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Editorial and executive offices: 812 Huron Rd., Cleveland 15, O.

LESTER P. AURBACH . . . . . *president*
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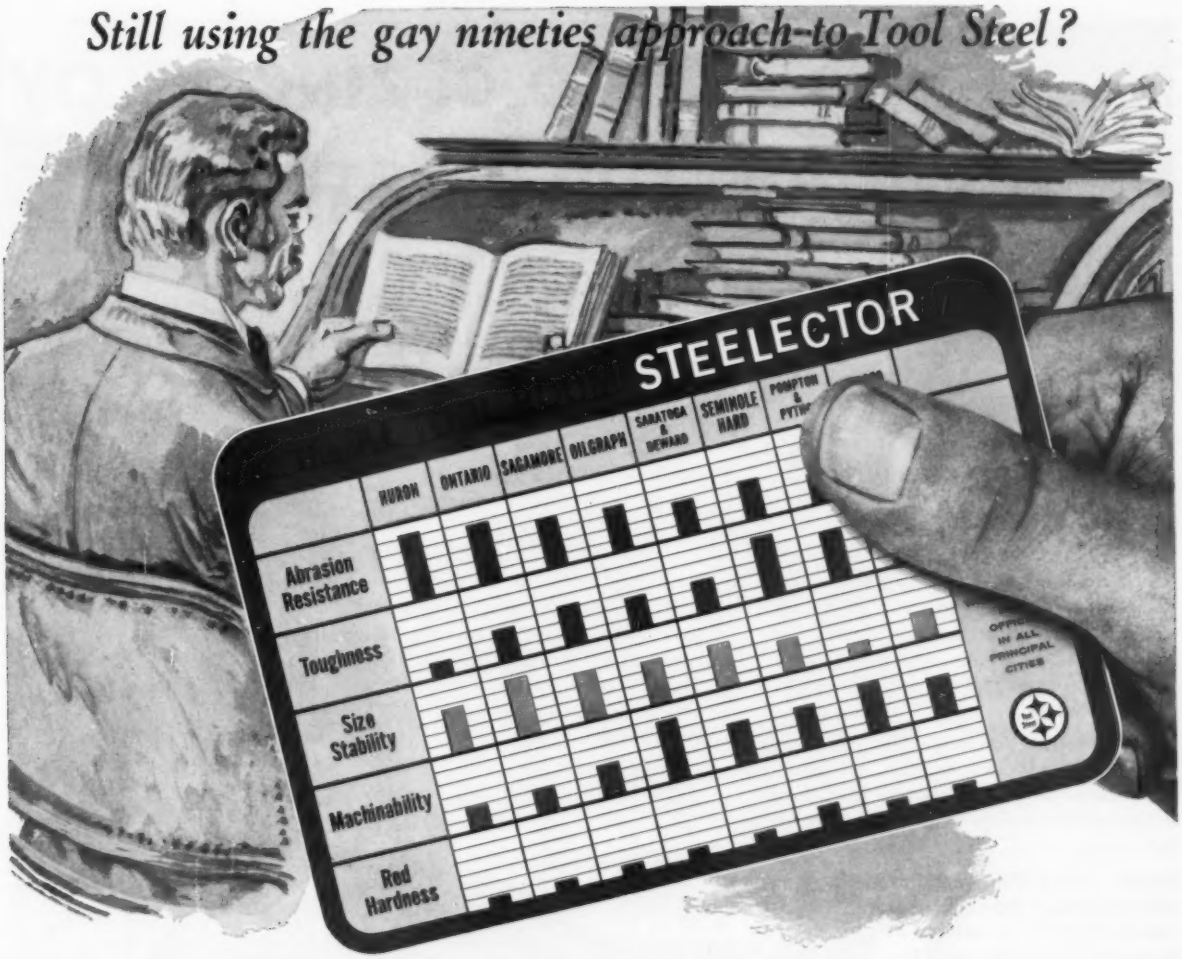
Still using the gay nineties approach to Tool Steel?



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The complete necessary range of sizes and shapes is listed in a special Data Stock List for every grade. These lists also include heat treating, typical working hardnesses and other data to insure that your selection is correct.

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For a complete explanation of the STEELECTOR Program, ask your Allegheny Ludlum sales representative for a copy of the colorful A-L Tool Steel STEELECTOR Booklet, or write: *Allegheny Ludlum Steel Corporation, Oliver Building, Pittsburgh 22, Pennsylvania. Address Dept. PM-12.*

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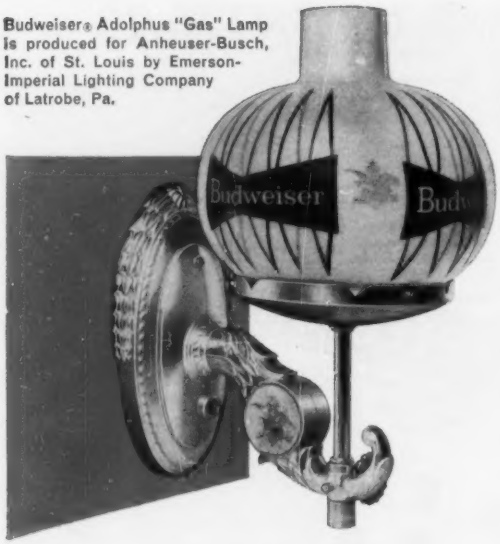

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Yes, Budweiser® Adolphus "Gas" Lamps by Anheuser-Busch, Inc., do just that—doubly so, because they're installed in pairs, flanking the ends of thousands of backbars across the country.

So you order a "Bud"®, and your eyes dance over the quaint old-fashioned design of the Lamp's base, as you wait to be served. How sharp the minute details of the design in the base appear—and are! The smooth, even fit of the parts . . . the soft, golden finish that glistens so bright . . .

Now you know! That elegant, ornate base is L. D. C. Zinc Alloy Die Casting! It has captured and preserved all the warmth and friendliness of a Century passed through modern design techniques and color treatment that only quality workmanship through quality materials can produce.

L. D. C. Zinc Alloy Die Castings electroplate easily and retain a high gloss polished finish.

Dimensional stability and strength of L. D. C. Zinc Alloy Die Cast shells assure neat, accurate fit, and a smooth, even finish that sharpens design details.

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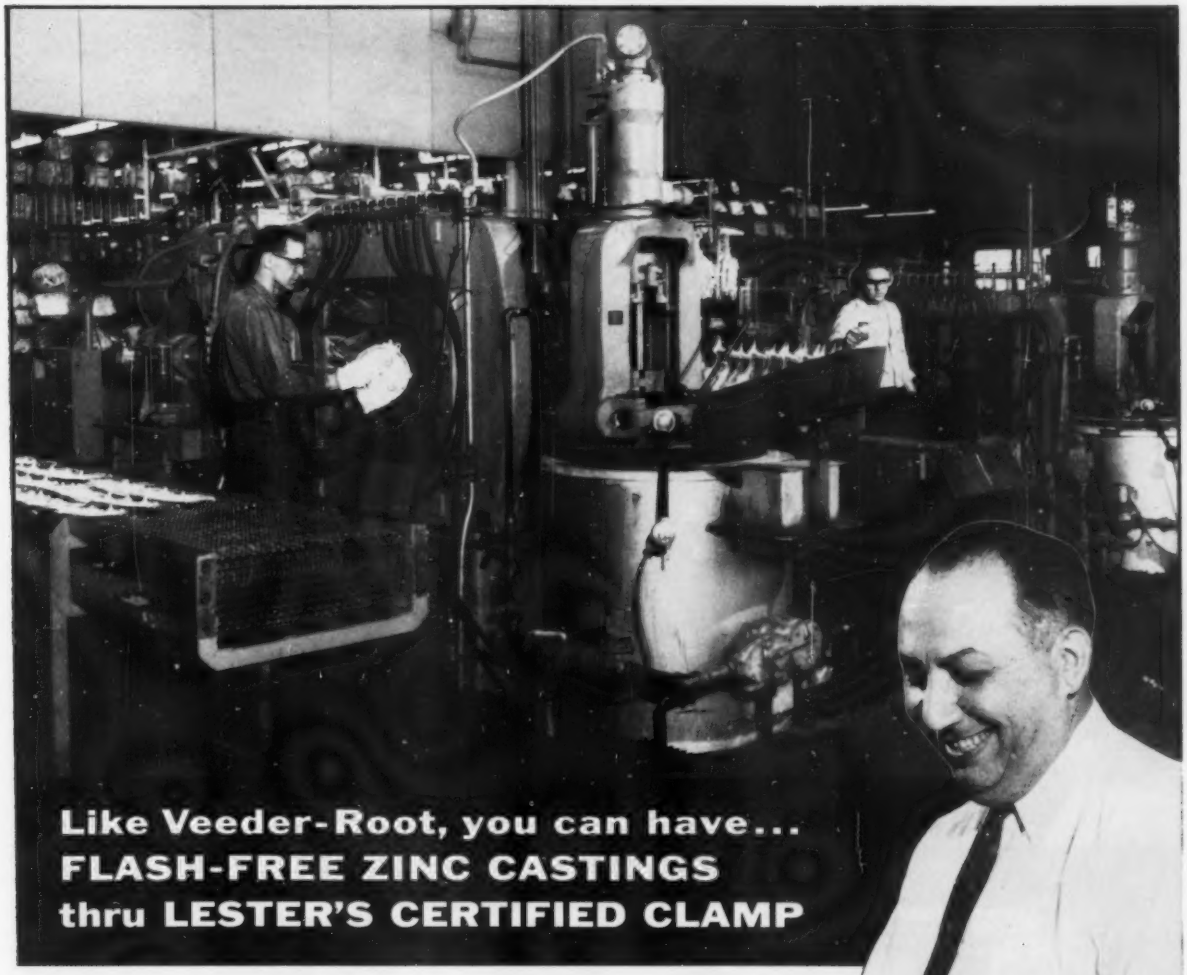

Like Veeder-Root, you can have... FLASH-FREE ZINC CASTINGS thru LESTER'S CERTIFIED CLAMP

In their zinc die casting, Veeder-Root, Incorporated, manufacturers of computors and counting instruments, operates on the widely-accepted theory that good die casting practice starts with flash-free parts. On their Lester machines, the *certified* clamping tonnage, the evenly divided pre-load and the fully supported moving platen give them what they need to make such flash-free parts.

Casting against a parting line which is evenly locked around every inch of its perimeter, they are able to apply years of casting know-how, in terms of metal temperatures, shot pressures and speeds to get the most production out of their dies.

Having used Lesters for over 18 years on parts for their products, Veeder-Root specified 400- and 600-ton Lesters to run their new work. With the Lesters they get the kind of zinc die castings they need because the Lesters have the kind of locking pressures they need—no so-called "normal blowback" experienced with machines of less reliable construction.

Mr. Joseph Del Canto, general foreman at the Altoona Division, is shown here holding a typical Veeder-Root part. In Mr. Del Canto's own words, "We like our Lesters because of easier and quicker setups and adjustments, more than adequate injection and holding pressures, and last, but not least, minimum maintenance."

If quality zinc parts is your die casting responsibility, it will help you to find out what Lesters can do for you.

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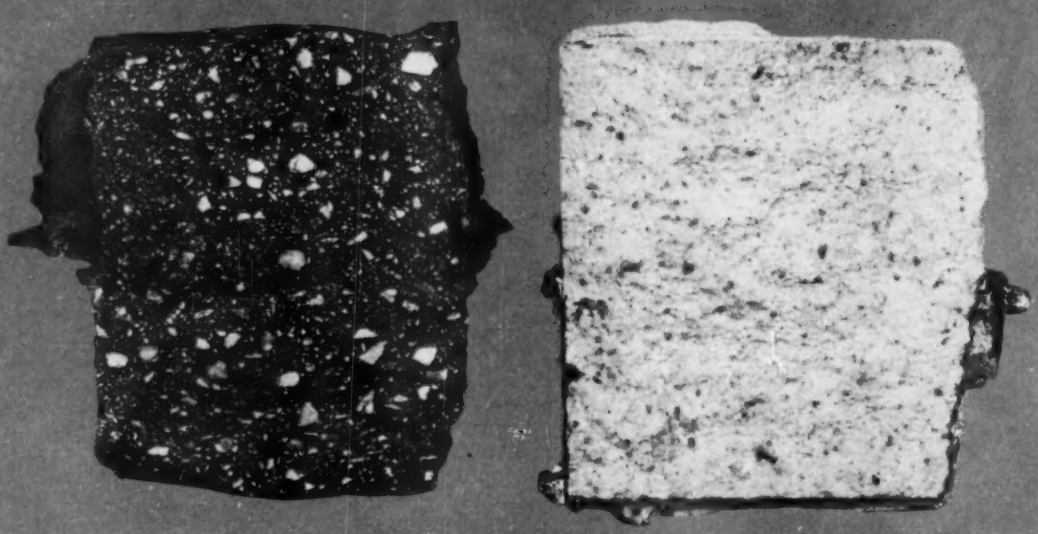
Tests demonstrate virtually complete resistance of CORAL brick and CORALBOND to aluminum alloy action.



Aluminum Immersion Test—This picture illustrates the superior resistance of CORAL to penetration and reaction by a molten aluminum alloy as compared with a 90% alumina brick of high quality. After three weeks immersion in molten alloy (70-75) at 1500°F., the 90% alumina brick on the left is completely penetrated and appreciably affected while CORAL on the right is entirely free of damaging effects.

Mortar Joint Test —Photograph of laboratory cup-test with molten aluminum alloy shows remarkable resistance to penetration and corrosion by CORALBOND mortar in the joint cementing together two sections of 90% alumina brick.

For further information about these brands,
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CORAL BRICK . . . CORALBOND
developed specifically for aluminum melting
FULFILL ALL OPERATING REQUIREMENTS

The remarkable progress in the increasing utility of aluminum and its multiplicity of important new alloys is closely paralleled by Harbison-Walker achievements in producing the refractories needed for some of the unusual furnace conditions. The severity of corrosion, the more destructive impact accompanying furnace charging and the necessity of avoiding contaminants for meeting rigid alloy specifications—these among other factors continue to assume greater importance in the use of the proper refractories.

Since the first commercial production of aluminum and its alloys, Harbison-Walker brands, primarily of alumina-silica and high-alumina compositions, have continued to fulfill the ever growing demands. Through unceasing research, several refractories developed specifically for aluminum melting furnaces possess definitely superior properties for maximum durability and the best quality of metal.

THE CORAL BRANDS

The extraordinary combination of superior properties of CORAL brands of stabilized high-alumina brick (85% Al_2O_3 class) accounts for their pre-eminent service records. Made in several variations, they are uniquely adapted for withstanding different sets of conditions involving the effects of molten alloys, thermal shock, spalling conditions, severe impact and abrasion.

CORAL BP is the hard-fired variation of the stabilized aluminum phosphate bonded brick. It has the highest mechanical strength. Because of its excellent resistance to reaction by many alloys, this brand is especially suitable for use in furnaces in which contamination must be avoided. CORAL P is the stabilized phosphate chemically-bonded brick which possesses the excellent properties of resistance to penetration and reaction by the molten metal.

CORAL is a very hard-burned brick made with a special bond (patent pending) which enhances its remarkable strength and resistance to penetration and reaction with the most fluid alloys of aluminum.

With these brands furnace wall accretions are very slight which greatly contributes to easiest cleaning.

CORALBOND is a phosphate bonded high-alumina mortar produced specifically for use in aluminum melting furnaces. In this application it is unmatched for its durability because of its high strength and corrosion resistance. These properties together with its special composition contribute to the avoidance of metal contaminants. Compared with the many different kinds of mortars, CORALBOND is truly unique in its excellent performance in aluminum furnaces.

Included among these Harbison-Walker aluminum furnace refractories of special merit are H-W HARCHROME CASTABLE particularly suited for making the most substantial repairs and various monolith-forming refractories for many designs of secondary remelting furnaces.

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NEW POWDER METALLURGY TECHNIQUE

Bo-Stan, a new high-temperature reactor control material, has been developed by the Sintercast Division of Chromalloy Corporation. The carefully balanced, uniform dispersion of boron in stainless steel is prepared by the Sinterwrought process, an advanced powder metallurgy technique.

Being produced by a solid state process, the resulting material is readily predictable, reproducible, and homogeneous. After sintering and hot-working, the composite is as fully dense, ductile, and strong as a cast alloy of equivalent composition.

Boron, due to its affinity for neutrons, is of vital interest as a flux attenuator in nuclear reactors. Theoretically, its combination with stainless steel offers an ideal material which is strong, easily fabricated, and resistant to corrosion and high temperatures. This combination is of particular interest in pressurized water reactors, where problems of oxidation and high temperature prohibit the use of aluminum and its alloys.

Despite many recent advances, such as the use of vacuum fusion, alloys of boron and stainless steel suffer serious disadvantages. One major difficulty lies in the tendency of boron literally to ooze out of the alloy, especially during hot-working. This deboronization drastically alters the neutron-capturing ability of the reactor material, sometimes very unevenly.

"In nuclear technology," explains John L. Ellis, vice-president of Chromalloy Corporation and general manager of its Sintercast Division, "uniformity of boron distribution in the stainless steel carrier metal is of particular importance. With conventional alloying procedures employed to-date, boron could not be dispersed uniformly. Because the lighter element segregated, more boron accumulated in some areas than in others. Such a condition is intolerable in a material used to control neutron flux."

INVESTMENT CASTING WITH MISCHMETAL

Ronson Metals Corporation announced the availability of new data on "Recommended Additions of CerAlloy 100 (Mischmetal) in Precision Castings", prepared by Dr. Norman E. Woldman, Consulting Metallurgist for the Company.

The data covers additions of CerAlloy 100 Mischmetal to improve fluidity for better castability for various section thicknesses of carbon steel, low-alloy steel, cobalt-base alloys, stainless steels, hot work tool steels, nickel-base alloys, aluminum alloys, and copper-base alloys.

Extruded pellets of CerAlloy 100 Mischmetal are manufactured especially for precision castings by Ronson.

Table 1 shows some of the data included in the report.

The values shown in per cent are the amounts of CerAlloy 100 (mischmetal) to be added in each case to the respective molten metal prior to casting and in accordance with the minimum section thickness of the casting. The thinner the section, the higher the amount of CerAlloy 100 necessary.

RECOMMENDED ADDITIONS OF CerAlloy 100 (MISCHMETAL) IN PRECISION CASTINGS

Alloy	Composition	Section Thickness	CerAlloy 100 %	Section Thickness	CerAlloy 100 %	Section Thickness	CerAlloy 100 %
Carbon Steel	SAE 1015 thru SAE 1050	1/8-3/8	0.15	3/8-3/4	0.15	over 3/4	0.10
	1055 thru 1095	1/8-3/8	0.2	3/8-3/4	0.2	over 3/4	0.2
Low Alloy Steel (low to med. carbon)	SAE 2100	1/8-3/8	0.2	3/8-3/4	0.2	over 3/4	0.15
	SAE 3100	1/8-3/8	0.2	3/8-3/4	0.2	over 3/4	0.15
	SAE 4100	1/8-3/8	0.2	3/8-3/4	0.2	over 3/4	0.15
Cobalt-Base Super Alloys	Haynes Stellite	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
	Alloy S-816	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
	Alloy X-40	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
	Alloy L-605	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
	Refractaloy	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
	Rexalloy 33	1/8-3/8	1.0	3/8-3/4	1.0	over 3/4	0.8
Stainless Steel	300 Series	1/8-3/8	0.6	3/8-3/4	0.6	over 3/4	0.6
	400 Series	1/8-3/8	0.4	3/8-3/4	0.4	over 3/4	0.3
Hot Work Tool Steels	Cr-base types	1/8-3/8	1.0	3/8-3/4	1.0	over 3/4	0.8
	W-base types	1/8-3/8	1.2	3/8-3/4	1.2	over 3/4	1.0
	Mo-base types	1/8-3/8	1.2	3/8-3/4	1.2	over 3/4	1.0
Nickel-base Super Alloys	Inconel	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
	Rene 41	1/8-3/8	0.8	3/8-3/4	0.8	over 3/4	0.6
Aluminum	Al-Cu	1/8-3/8	0.2	3/8-3/4	0.2	over 3/4	0.1
	Al-Si	1/8-3/8	0	3/8-3/4	0	over 3/4	0
Copper-Base Alloys	Leaded coppers, brasses or bronzes	1/8-3/8	0.2	3/8-3/4	0.2	over 3/4	0.2
	Beryllium copper	1/8-3/8	0.4	3/8-3/4	0.4	over 3/4	0.3

Unmatched purity and uniformity:

FEDERATED ZINC DIE CASTING ALLOYS

Completely controlled production provides you with die cast metals of highest purity and uniformity. Federated Zinc die cast metal is made from ASARCO Special High Grade Zinc, electrolytically refined by Asarco-developed processes. Production is concentrated "under one roof" at Corpus Christi, Texas, one of the world's largest plants producing Special High Grade zinc and die casting alloys. Strategically located warehouse stocks assure you of prompt volume delivery. For complete information about FEDERATED Zinc Die Casting Alloys, write or call: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. or your nearby Federated sales office.

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AMERICAN SMELTING AND REFINING COMPANY

Low machining costs, superior castability, and an excellent plating surface are the big reasons why zinc die castings are favored for fuel pumps, carburetors, grilles, lamp housing, instrument panels, horn rings, and many other functional and decorative automotive components.

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PORTLAND 9, OREGON
Capitol 7-1404

ROCHESTER 4, NEW YORK
Locust 5250

ST. LOUIS, MISSOURI
Jackson 4-4040

SALT LAKE CITY 1, UTAH
Empire 4-3601

SAN FRANCISCO 24, CALIF.
Atwater 2-3340

SEATTLE 4, WASHINGTON
Main 3-7160

WHITING, IND. (CHICAGO)
Whiting: Whiting 826
Chicago: Essex 5-5000

IN CANADA: Federated Metals Canada, Ltd.
Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

Montreal, P.Q., 1400 Norman St., Lachine, Phone: Melrose 7-3591

Circle No. 7 on Reader Service Card

Before You Buy or Specify—

COMPARE

DIE CAST ZINC
With Other Materials

	ZINC ASTM XXIII SAE 903	ALUMINUM ASTM S12B SAE 305	PLASTIC (DELRIN*) *Delrin is a registered trade name of E. I. du Pont de Nemours & Co. (Inc.)
TENSILE STRENGTH	41,000 p.s.i.*	39,000 p.s.i.	10,000 p.s.i.
IMPACT STRENGTH	43 ft.-lb.*	2.0 ft.-lb.	1.4 ft.-lb.
SHEAR STRENGTH	31,000 p.s.i.	25,000 p.s.i.	9,510 p.s.i.
COEF. OF THERMAL EXPANSION PER °F	.0000152	.000011	.000045
MELTING POINT °F	727.9°	1080°	347°

DIE CASTING
is the process...

ZINC, the metal...

BUNKER HILL
The Preferred Zinc

ZN-173

***ZINC DIE CASTINGS HAVE BEEN TIME-PROVEN**

• After ten years of aging, the Tensile Strength of the Die Cast Zinc alloy is 35,000 p.s.i. and its Impact Strength is 41 ft.-lb. Because of the newness of Delrin, its ability to retain mechanical properties is unknown. Data in table above pertaining to Delrin is from the manufacturers own literature.

Another point to keep in mind—as a metal, Zinc has a hard surface and is less subject to scratching than plastic. Furthermore, it can be beautifully finished by plating.

For proven durability, specify Zinc.

BUNKER HILL 99.99+% ZINC

Eastern Sales Agents:
ST. JOSEPH LEAD CO. • 250 Park Avenue, New York 17, N. Y.
Sales Office for the Pacific Coast
THE BUNKER HILL CO. • 660 Market St. • San Francisco, Calif.

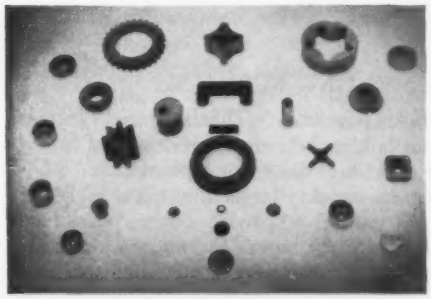
For profitable production...

THE HIGH-SPEED BALDWIN COMPACTING PRESS

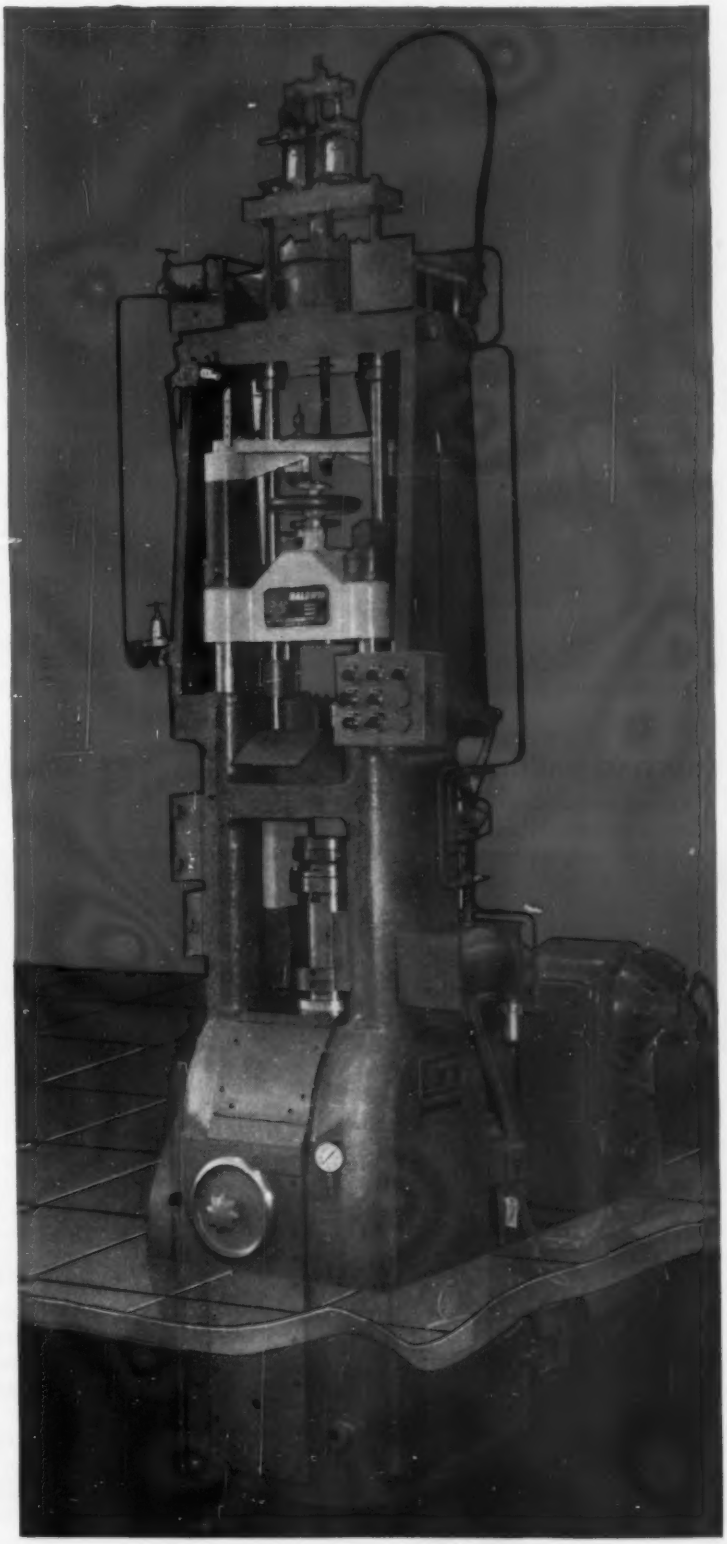
This versatile 75-ton compacting press can increase your profits through high-speed production and economical operation. Uniform die pressure, fast cycling, and 4-point guiding assure quick, accurate processing—whether of powdered metals, ceramics, abrasives, carbides, cermets, ferrites or nuclear and other solid fuels for rockets and missiles.

Motions and controls, integral with the unit, permit use of simple die sets to produce intricate parts. Hand wheels provide complete range adjustment of fill, punch entrance and ejection strokes. Present tools can be easily adapted because of readily accessible die space.

Another Baldwin advantage goes with it all. Expanded facilities at our new Industrial Equipment Division assure early delivery and continued high standards of manufacture. Write us for detailed information and specifications.



Some of the many fabricated parts formed on Baldwin compacting presses.



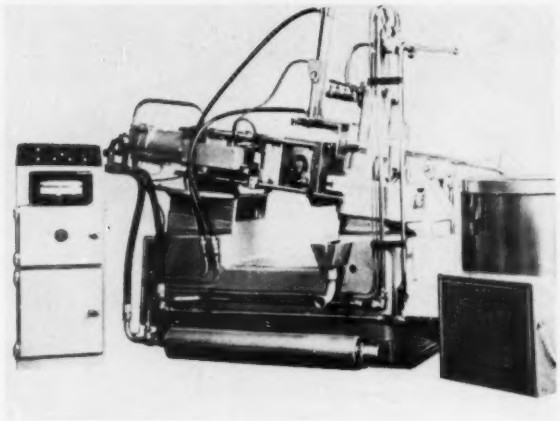
BALDWIN · LIMA · HAMILTON

Industrial Equipment Division · Philadelphia 42, Pa.

Circle No. 13 on Reader Service Card

NEW PRODUCTS AND DEVELOPMENTS

Qualified readers can get complete details on these products. Use the Reader Service Cards facing page 58. Information presented here is the manufacturers' own assessment of their products.



AUTOMATIC DIE CASTING MACHINE

DCMT SALES CORP.—The DCMT "Ram" fully automatic, 60-ton, zinc die casting machine now features switches which detect a stuck casting, flash, or other foreign matter between the dies as they close. Any such material causes the dies to retract and stop the cycle. Recycling continues after a brush device clears the obstruction. This "Di-Saver" system not only prolongs die life, but keeps flash to a minimum.

Split-second timing of the casting cycle increases production and improves the quality and finish of the castings by eliminating operator variables.

Designed specifically for high speed, the machine averages 1500 shots per hour.

Circle No. 235 on Reader Service Card

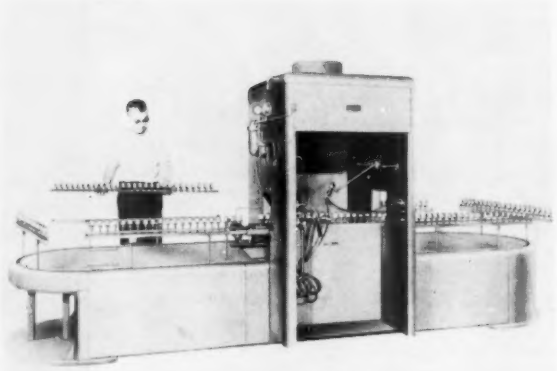
PAINTING MACHINE

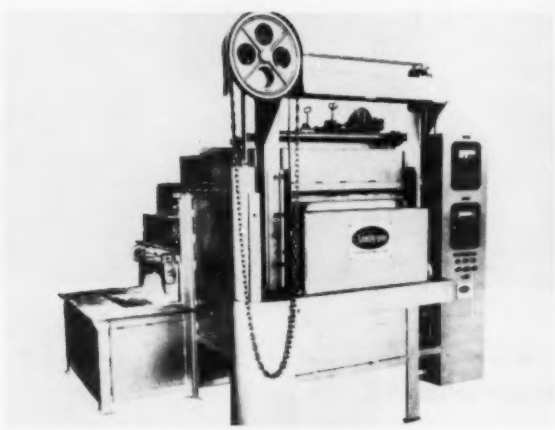
FINISH ENGINEERING CO., INC.—This new painting machine is especially adapted to multiple coat operation for prime and finish coating, baking, and metallizing. Each part to be coated is placed on a spindle mounted work holder. Instead of being attached to a moving chain, the spindles are mounted on carrier rods. The parts stay on the rod through all stages of finishing.

There are no finger marks on coated parts because they are never handled. Rejects are reduced.

The machine can be used either with rotating or non-rotating work holders and can be automated. There is no down time when changing from one painting job to another.

Circle No. 236 on Reader Service Card





ALUMINUM MELTING FURNACE

SUNBEAM EQUIPMENT CORP.—This dry hearth furnace for melting and holding aluminum is designed for use in permanent mold and die casting plants.

A sloping hearth quickly melts aluminum additions. Moisture which might otherwise cause porosity is evaporated on the hearth before the molten aluminum flows into the holding bath. Precise temperature control in the bath reduces scrap loss.

The furnace is easily adaptable to continuous pour operations. It may be supplied with end or side dip out wells to fit floor requirements. The unit can be built for operation with gas, oil, or combination fuel.

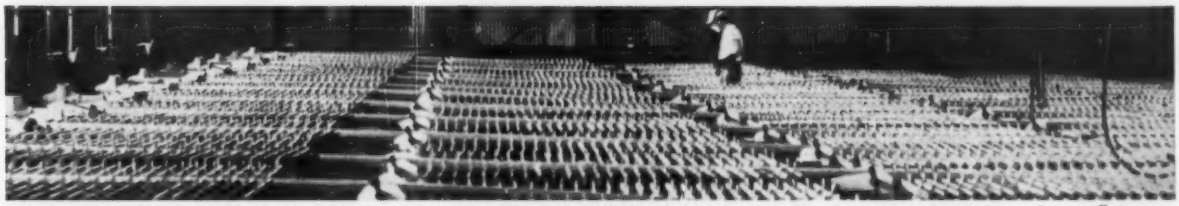
Circle No. 237 on Reader Service Card

continued on page 52

INTEGRATED PRODUCTION—from Ore to Ingot

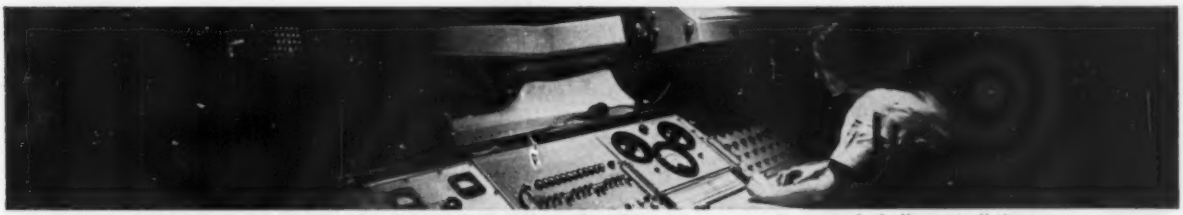
Underground scene in American Zinc's East Tennessee zinc mines. More than 50 years' reserve of zinc ore has been developed here.

Assures the Uniformity and Purity of



Cell room in American Zinc's electrolytic zinc plant at Monsanto, Ill. Special high-grade zinc is produced at this modern refinery.

AZCO Zinc Die Cast Alloys



Latest spectrographic analyzing equipment is employed to assure accurate control of alloys at all times.

You set your specification—get your specification with AZCO Zinc Die Cast Alloys. AZCO Alloys are produced from American Zinc special high-grade slab zinc—quality controlled from ore to ingot to assure the purity and uniform analysis you need for trouble-free production. From our Monsanto, Illinois, plant in the center of the "Zinc Zone," you get the fast, dependable service you need to meet your production schedules. Phone for immediate attention.

American Zinc sales company

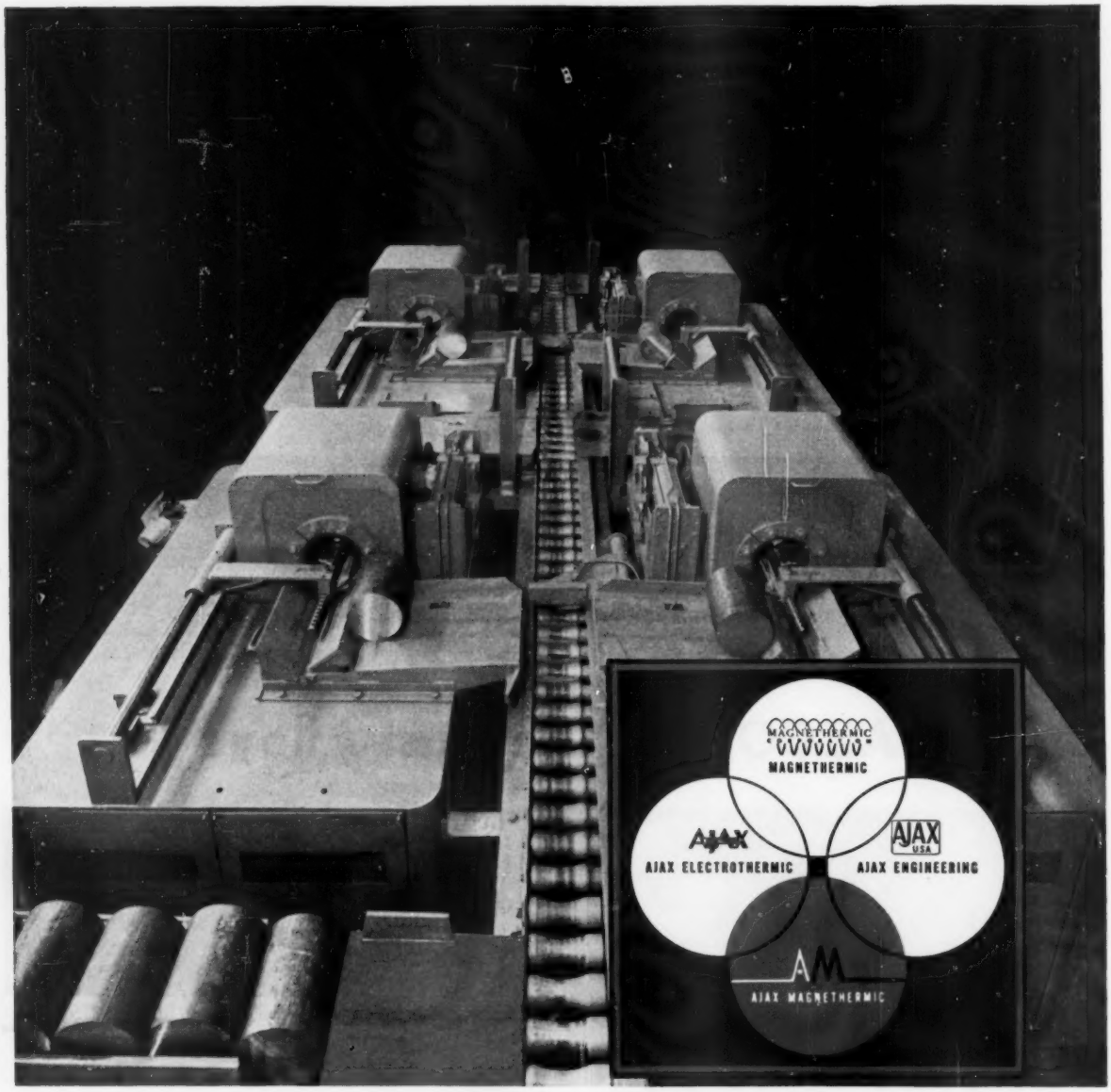
1515 Paul Brown Building, St. Louis 1, Missouri

Distributors for:

AMERICAN ZINC, LEAD AND SMELTING COMPANY

Detroit • Columbus, O. • Chicago • St. Louis • New York

Circle No. 8 on Reader Service Card



At Scovill Manufacturing Company, Waterbury, Connecticut, these four Ajax Magnethermic Induction Heaters heat 9" x 16" copper and brass billets for a 2500 ton extrusion press at the rate of 60 billets per hour. Each heater is rated 450 KW. The four heaters in tandem are served by a common loading and unloading conveyor.

THE NEW NAME WITH THE FAMILIAR RING!

60-Cycle Induction Billet Heaters manufactured by AM, one of our many products for induction heating or melting of all types of metals.

"induction heating is our only business"

Ajax Magnethermic CORPORATION

GENERAL OFFICES
P. O. BOX 839
Youngstown 1, Ohio

TRENTON DIVISION
930 Lower Ferry Road
Trenton 5, New Jersey

YOUNGSTOWN DIVISION
3990 Simon Road
Youngstown 1, Ohio

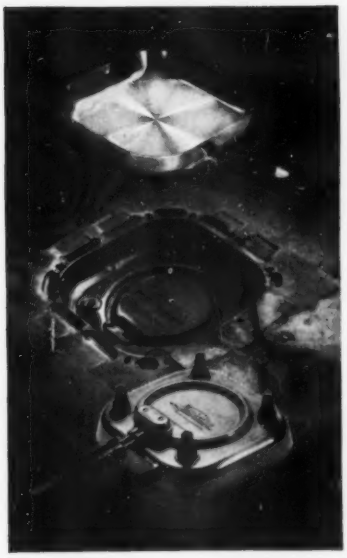
Circle No. 3 on Reader Service Card

Helpful Hints for Die Casters

—from Bethlehem's Tool Steel Engineer

Air Quenching Improves Service Life of Hot-Work Tools

The majority of hot-work tool steels can be hardened by quenching in oil or air. Because of greater convenience in handling, as well as to avoid excessive scaling, many hot-work tools are quenched in oil. However, it is better practice to use air-quenching because air-quenched tools have lower residual stresses than tools which have been liquid-quenched. Failures caused by heat checking are the direct result of surface stresses produced in service, so it's desirable to minimize residual stresses in the tool itself which can lead to premature failure. Tools which have low residual stresses are best suited for long service life on hot-work applications. That's why air-quenching is generally best for hot-work tools.



Why Cromo-High V Tool Steel Is Ideal for Die Casters

Bethlehem Cromo-High V is a reliable performer in die casting aluminum-base or magnesium-base alloys at 1200-1300 F. Having a 5 pct chrome, high-vanadium content, Cromo-High V comes annealed to Brinell 207, for easy machining. It resists heat-checks. And it develops uniform hardness in large sections during heat-treatment, enabling it to resist wash and erosion. For full particulars, get in touch with your Bethlehem tool steel distributor.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.
Export Sales: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

Circle No. 14 on Reader Service Card

ALUmelt

Crucibles for melting and holding aluminum

***ALUmelt crucibles offer:**

Faster melting time

Better service life

Least contamination

Up to 35% savings on initial investment

More capacity

Easier cleaning

*** as reported by user foundries**

Send for our new Alumelt brochure . . . completely details the advantages of Alumelt for you.

VESUVIUS CRUCIBLE CO., P.O. Box 8275, Pgh. 18, Pa.
Send Alumelt brochure to:

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Firm Name.....

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City..... Zone..... State.....

CONCEIVED AND DEVELOPED BY
VESUVIUS CRUCIBLE CO.
FOR THE METAL POURING INDUSTRY
SWISSVALE • PITTSBURGH 18, PA.

Make

ALAN WOOD

your

IRON POWDER HEADQUARTERS

Dependable Uniformity, Delivery, Service

A. W. Iron Powder can be your key to new design flexibility, reduced production costs and products of superior quality with closer tolerances. A.W. Iron Powder assures you of high purity, uniformity of size and composition . . . plus outstanding fabrication properties. Custom-mixed blends are readily produced to meet your most exacting specifications.

You're assured of prompt deliveries with A.W. Iron Powder, now being manufactured in volume in our 50-ton-a-day direct reduction plant. Behind these modern facilities are years of pilot plant operation, thorough testing and proving in customer applications.

And you're assured, too, of continuing quality and competent service. A.W. Iron Powder is backed by the full resources of Alan Wood Steel Company . . . extensive laboratory and research facilities . . . application engineering . . . and Customer Advisory Service to help make your investment more productive. Send today for technical data and application information . . . fill in the coupon below for samples and details.

ALAN WOOD STEEL COMPANY

CONSHOHOCKEN, PA.

FOR MORE INFORMATION

Manager
Iron Powder Sales
Alan Wood Steel Company
Conshohocken, Pa.

I am interested in Iron Powder for:

☐ Molding ☐ Friction ☐ Other

☐ Send literature
☐ Send sample

NAME_____

TITLE_____

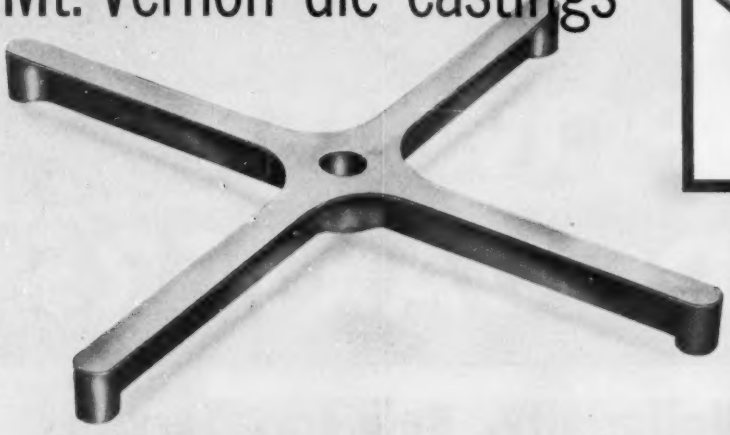
COMPANY_____

ADDRESS_____ CITY_____ STATE_____

AMERICAN STEELMASTERS FOR 135 YEARS

Circle No. 4 on Reader Service Card

Steel furniture manufacturer gets **these 5 benefits** from Mt. Vernon die castings



CASE HISTORIES FROM MT. VERNON FILES

Subject:

Art Steel Company, New York City

In a major switchover, Art Steel Company makes this handsome Steelmaster Desk with aluminum die cast legs. The companion Executive Chair stands on a die cast aluminum base. Formerly it took 8 parts to assemble each island leg of the desk . . . and 14 parts for the chair base. But switching to die cast parts gave Art Metal Company 5 major benefits:

1. Simpler fabrication since all castings are one-piece integral units. No more multiple section subassembly work.

2. Complete freedom in designing due to the many inherent advantages of the die casting process.

3. Corrosion of legs and bases caused by office cleaning detergents no longer a problem. Aluminum die castings stay bright and attractive.

4. Die castings are delivered polished, drilled and tapped, ready for use. Several assembly steps previously required have been eliminated.

5. Because production of legs and bases has been put into Mt. Vernon, valuable production capacity at Art Steel has been freed for other requirements.

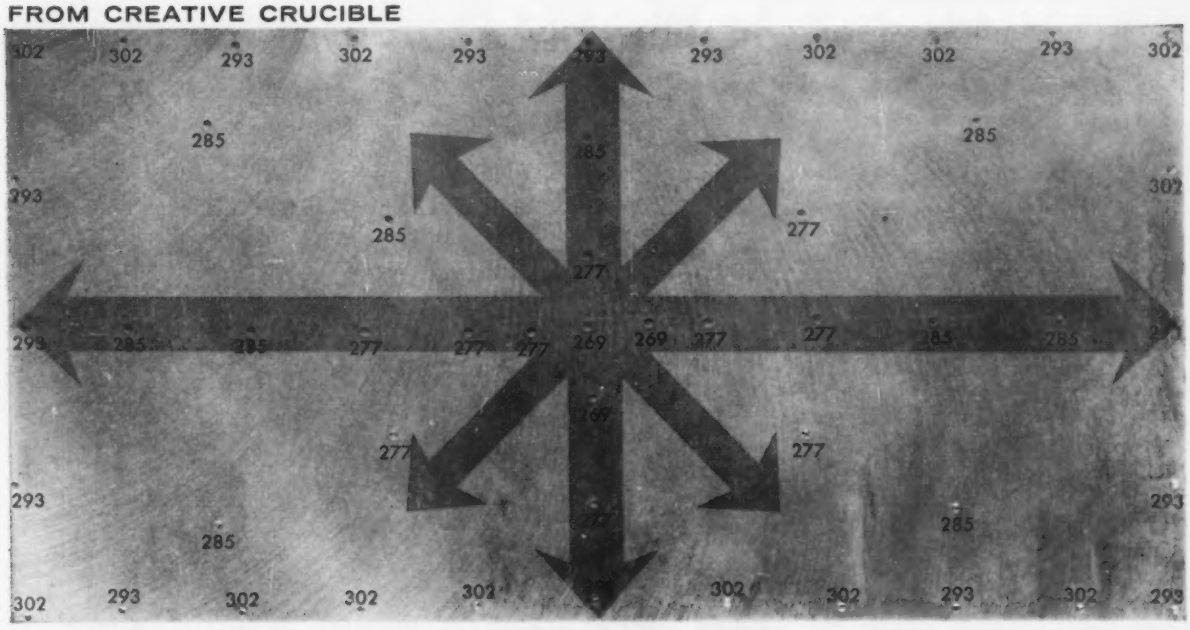
More and more, in a great variety of products, Mt. Vernon Die Castings are replacing complex sheet metal assemblies and costly, crude sand castings, bringing significant production economies to the manufacturer. All the knowledge we have gained on this subject is also available to you . . . free. Why not discuss your problem with us too. A call to your nearest Mt. Vernon representative will bring you action.

MT. VERNON DIE CASTING CORPORATION
STAMFORD, CONNECTICUT

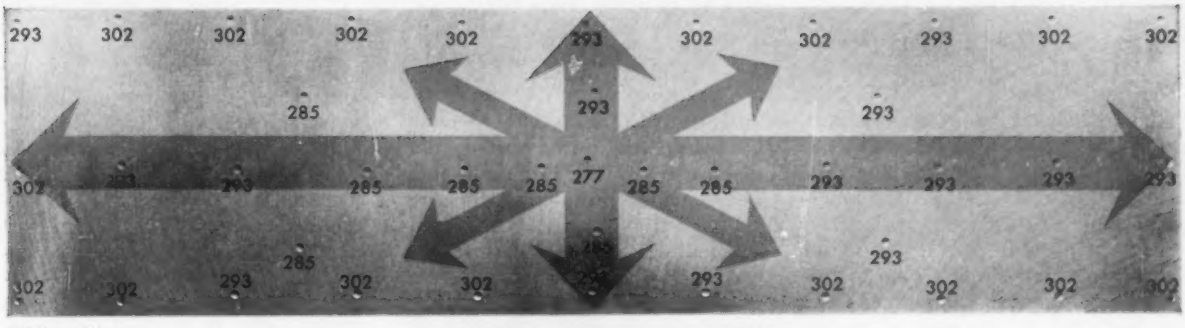
SALES REPRESENTATIVES
BALTIMORE, MD.: Mr. C. M. Gordan, 919 St. Paul St.
BROOKLYN, N. Y.: Mr. Robert V. Moore, 2317 Plumb 2nd St.
CLEVELAND, OHIO: Mr. Grant Eller, 6 East 194th St.
MARIETTA, N. Y.: Mr. Burt J. Meldrum, Olanco Road
PITTSBURGH, PA.: Mr. Andrew W. Anderson, 300 Pasadena Drive So.
STAMFORD, CONN.: Mr. Anker Anderson, Cascade Road
VALLEY FORGE, PA.: Mr. G. T. McMaster, P.O. Box 115

Circle No. 47 on Reader Service Card

FROM CREATIVE CRUCIBLE



20" x 10"



20" x 5"

CSM 2

with positive, high hardenability

Now you can make larger plastic molds and die casting dies—for longer runs—and get better finishes!

Notice the small hardness gradient—across the surface and from surface to center—of these typical blocks of prehardened CSM 2. This small gradient indicates the more uniform hardness of CSM 2—and assures you of at least 5 major benefits:

- more uniform polish from top to bottom of cavity
- greater resistance to washing at center or bottom of cavity
- more positive shut-off surface—particularly in internally landed molds and dies
- more uniform machining characteristics from top to center of cavity
- elimination of heat treatment of most plastic injection molds and zinc die casting dies in sections up to 14" to 15" thick.

Complete details on Crucible CSM 2—either prehardened or annealed—are readily available through local Crucible steel service centers. For data, call the center nearest you or write: *Crucible Steel Company of America, Dept. TL27, Pittsburgh 30, Pa.*

CRUCIBLE STEEL COMPANY OF AMERICA

Circle No. 19 on Reader Service Card

NEWS OF INDUSTRY & ASSOCIATIONS

activities of people, companies & groups in the precision metal molding industries

PYRON BUILDING NEW IRON POWDER PLANT

Pyron Company, a unit of the Amco Division of American Metal, Climax, Inc., is building a new, highly automated iron powder plant in Niagara Falls, New York.

Alfred E. Beck, Jr., president of Pyron said that the completion of this plant in the spring of 1961 will triple the company's production capacity and bring the total investment by AMAX in iron powder facilities during the past 12 months to $3 million. The plant will be constructed to permit easy and economical expansion should the demand for iron powders continue to grow.

AMAX entered the iron powder field in May when Pyron, which currently produces about 20% of the total annual output for structural parts, was acquired by the Amco Division. The company now leases space from Hooker Chemical Corp. in Niagara Falls. The new plant will permit all Pyron operations for the first time to follow a continuous production flow.

Included in the new plant are development facilities for alloy powders which research studies show to have considerable market potential.

Incorporated in 1942, Pyron was one of the first to produce iron powders in the United States.

INSPECTION MOVIE OFFERED

A full color and sound, 23 minute 16mm motion picture, "How to Locate Flaws with Dye Penetrants," has been completed by Turco Products, Inc., and is available for free showing to industrial concerns, technical groups, and other interested organizations.

Intended primarily for training purposes, the film visually demonstrates every aspect of dye penetrant inspections from laboratory theory to authentic production-line techniques. It was filmed on location during actual mass production dye penetrant inspections.

ICI ELECTS OFFICERS AT CHICAGO MEETING

ICI OFFICERS AND DIRECTORS: (front row, l to r) R. E. Gray, J. H. Morison, R. F. Waindle, L. R. Schwedes; (back row, l to r) W. A. Dubovick, J. H. Cadieux, R. R. Miller, P. J. Nilsen. Missing from the photo is T. N. Thys.

The INVESTMENT CASTING INSTITUTE, at its Eighth Annual Meeting, elected officers for the coming year.

Re-elected were: President—John H. Morison, president, Hitchiner Mfg. Co., Inc.; vice president, management—Richard E. Gray, vice president, Gray-Syracuse, Inc.; vice president, technical—R. F. Waindle, president, WaiMet Alloys Co.; treasurer—L. R. Schwedes, co-owner, Lawrence Laboratory.

Re-elected directors are: J. H. Cadieux, vice president, Casting Engineers, Inc.; P. J. Nilsen, president, Electronicast Div., Nilsen Mfg. Co.; W. A. Dubovick, president, Engineered Precision Casting Co.; Thierry N. Thys, vice-president, Precision Foundries, Inc.; R. R. Miller, president, Precision Metalsmiths, Inc.

Papers presented at the Seminar were: Ways and Means of Heat Treatment Applicable to Investment Casting, by F. K. Iverson, Cannon Muskegon Corp.; Equipment and Control of Heat Treating for Ferrous and Non-Ferrous Castings, by H. F. Coyle of Leeds and Northrup Co.; Heat Treatment, Decarburization and Carbon Restoration in Low Alloy Steels, by R. V. Novy, of Lindberg Engineering Co.; Problems of In-plant Heat Treating, by E. M. Broad, Hitchiner Mfg. Corp.; and Working With the Outside Heat Treatment Firm, by W. A. Dubovick of Engineered Precision Casting Co.

BARTON KALISCHER

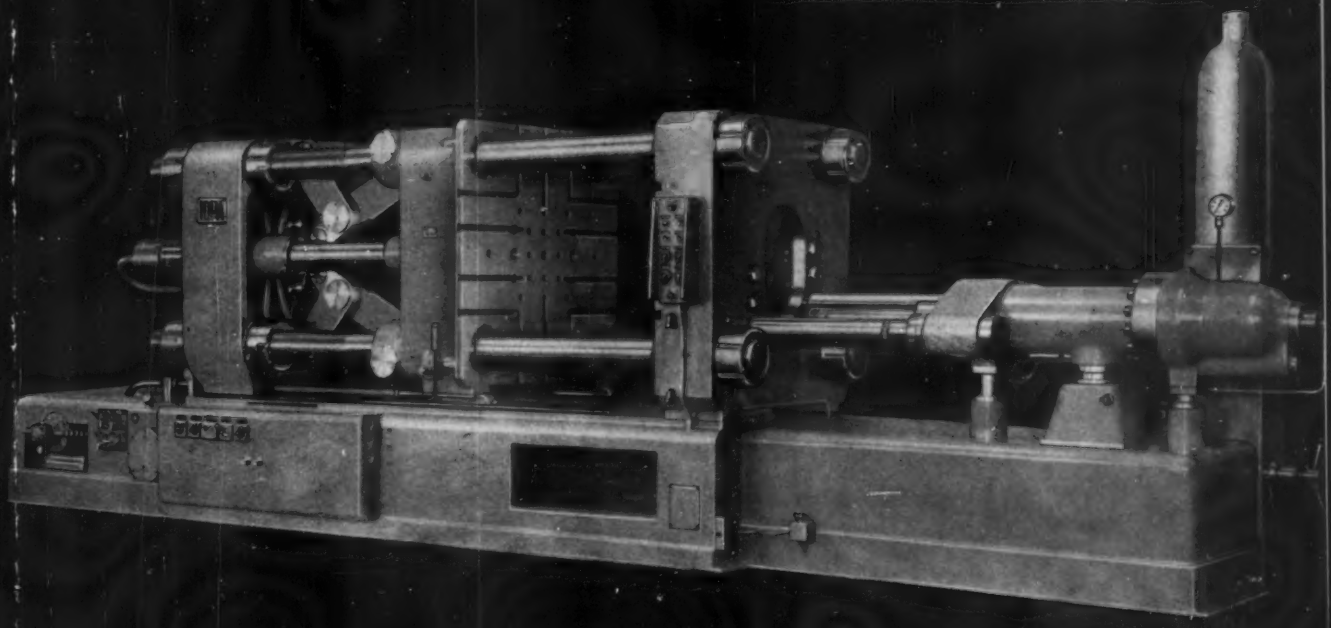
FOREIGN EDITOR IN USA TO DISCUSS DIE CASTING

During his visit to the United States last month, Hiram K. Barton, PRECISION METAL MOLDING foreign editor, conferred with Editor, Philip Kalischer on plans to expand PMM's coverage of foreign developments in the die casting fields.

Barton also presented a paper at the National Die Casting Congress and talked before the Cleveland chapter of the SDCE.

more industry news on page 56

DIE CASTING MACHINES



MODEL **OL 800** DIE CASTING MACHINE WITH
HORIZONTAL COLD CHAMBER
(880 TONS LOCKING PRESSURE)

IDRA

COSTRUZIONI IDROMECCANICHE BRESCIANE

pubblicità IDRA n. 712/60

SPECIFICATIONS:

LOCKING PRESSURE	880 tons
INJECTION PRESSURE	82,5 tons
DIMENSIONS OF PLATENS	51" x 51"
SPACE BETWEEN TIE BARS	31 1/2" x 31 1/2"
MOVABLE PLATEN STROKE	20 11/16"
MAX. HEIGHT OF DIES	39 3/8"
MIN. HEIGHT OF DIES	15 3/4"
FREE CYCLE PER MIN.	4 n.
MAX. WEIGHT OF ALUMINIUM PER SHOT	30,86 lbs.

WE MANUFACTURE: Die Casting Machines with horizontal cold chamber, with vertical cold chamber, with hot chamber (for Zinc alloys). Water hydraulic Die Casting Machines.

IDRA BRESCIA (ITALY)

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CABLE: IDRA - BRESCIA, ITALY

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pure nickel for critical alloying

When the specifications call for *pure* nickel, you can count on Sherritt as a reliable source of supply. Sherritt's unique hydrometallurgical refining process yields nickel powders with a purity of 99.9%. This high-purity nickel comes to you in handy briquettes and in three grades of powder for faster, easier alloying. The low chilling property of Sherritt briquettes and powders makes them particularly desirable for alloying additions at the end of the heat. Special nickel grades and coated powders are also available. FOOTE MINERAL COMPANY *is the exclusive sales agent for Sherritt nickel and cobalt in the United States and Canada. For complete illustrated brochure with prices and delivery information, contact the Foote Mineral Company, 474S Eighteen West Chelten Buildin; Philadelphia 44, Pa.*

SHERRITT GORDON MINES LIMITED

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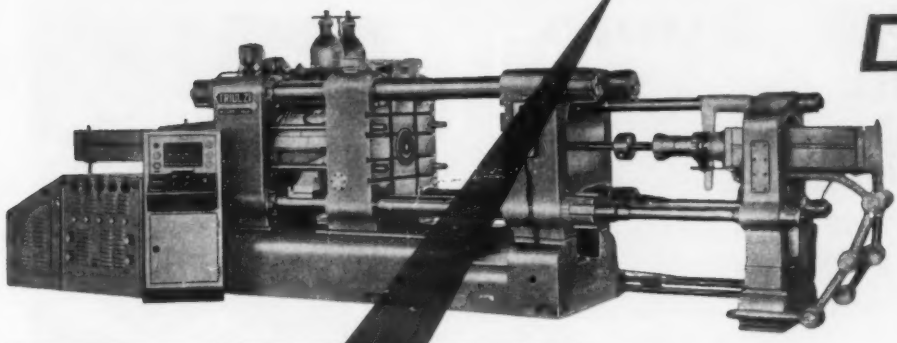

castmatic

Model 700 T.
cold chamber

- oil hydraulic
- automatic
- wedge lock positive clamping
- platens adjusted by motorized central screw
- electric panel for choosing **8 different working programs**
- working speeds up to **400 dry cycles per hour**

Characteristics	Mod:	1[illegible]		700	1,000
Max. shot capacity (Al.)	pounds	[illegible].0	11.9	18.7	31.5
locking force	U.S. Ton	[illegible]	550	770	1,100
Max. Thickness of the die	inche	[illegible]	29.5	22	39.5
platens adjustment	inc	[illegible]	18	8	20
opening stroke	[illegible]	[illegible]	18	26	27.5
dry cycles	[illegible]	550	350/450	250/400	250/360

DIE CASTING MACHINES

- **cold chamber, horizontal and vertical from 135 to 2500 U.S. Tons**
- **hot chamber, from 135 to 1100 U.S. Tons**

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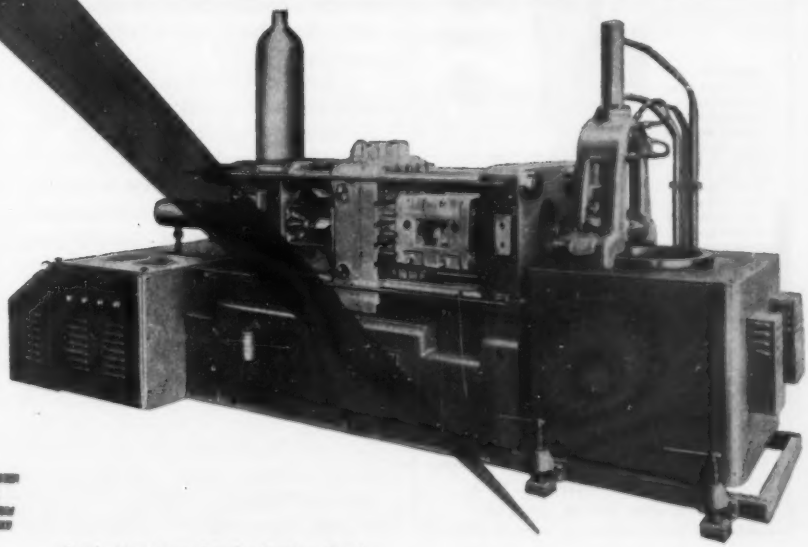
WE ALSO MANUFACTURE:

INJECTION MOULDING MACHINES for thermoplastics
PRESSES for metal sheets and various operations
PUMPS and water hydraulic plants

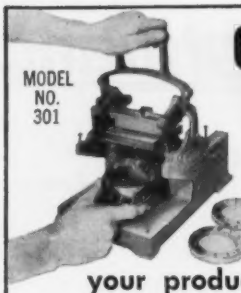
Model Z/250
hot chamber

- oil hydraulic
- wedge lock positive clamping
- electric panel for choosing **8 different working programs**
- working speeds up to **600 dry cycles per hour**



castmatic

Circle No. 61 on Reader Service Card



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PMM LETTERS

the readers' forum

CAST DIES

It is our understanding that a new method has been devised for manufacturing pressure casting dies as well as for extrusion and drawing dies.

Further, we understand that the steel component parts of the tools –punch and die–are cast directly in special ceramic molds. The steel is melted in an induction furnace and poured into the mold. Outstandingly accurate parts, requiring very little subsequent machining, are secured.

Please advise us whom to contact for full details.–S.J.B.

The process to which this reader refers is probably the Shaw Process for making tools, dies, and finished parts. This process is similar to investment casting in many of its phases. Complete information on the Shaw Process can be obtained from the British Industries Corp., 80 Shore Rd., Port Washington, Long Island, N.Y.–Ed.

CHEMICAL ETCHING

I wish to use photoetching in development of detail in model locomotive patterns.

I would appreciate your help in obtaining processing information and equipment necessary for electrolytic etching of stainless steel, brass, nickel silver, etc. for use on a moderate production basis and for sheet stock of approximately 8" x 10".

I have obtained rather complete data on the photographic and plate sensitizing end from Eastman, but have been unable to get sufficient information on DC power supply, etch solutions, anode and cathode differentials, current to material regulation, aerating and circulating data, also tank material.

Can you give me any information on this type of work and equipment.–M.V.C.–owner.

We suggest that you contact the United States Chemical Milling Co. at Manhattan Beach, Calif. This company has specialized in chemical etching and metal removal under controlled conditions.–Ed.

"the HITCHINER way..."

. . . and non-machinable super alloys in INVESTMENT CASTING

These spray nozzles for highway striping paint sprayers were formerly machined out of cold rolled bar stock. When ordinary paint was used, these nozzles functioned satisfactorily. However, when ground glass was added to the paint for reflecting purposes excessive wear caused frequent replacement.

By "the HITCHINER way . . .", we were able to engineer the manufacture of this part by investment casting in a non-machinable type alloy exhibiting a very high degree of resistance to both wear and corrosion.

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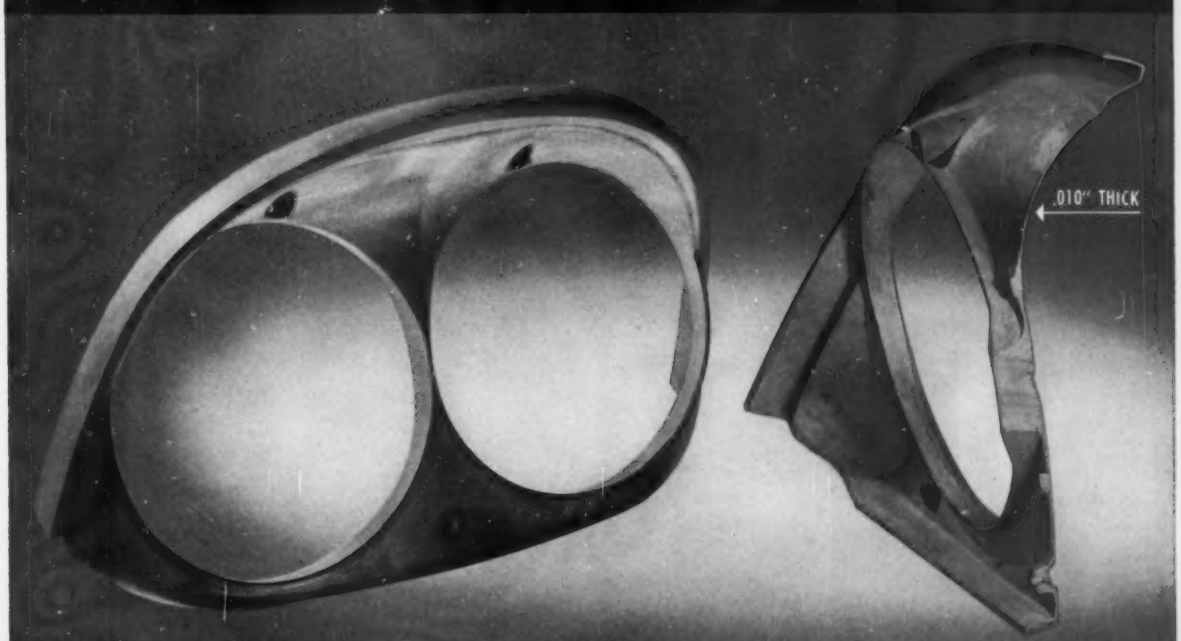

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Improved techniques in chromium plating on Zamak die cast parts provide a more permanent bright finish with greater resistance to corrosion than ever before.

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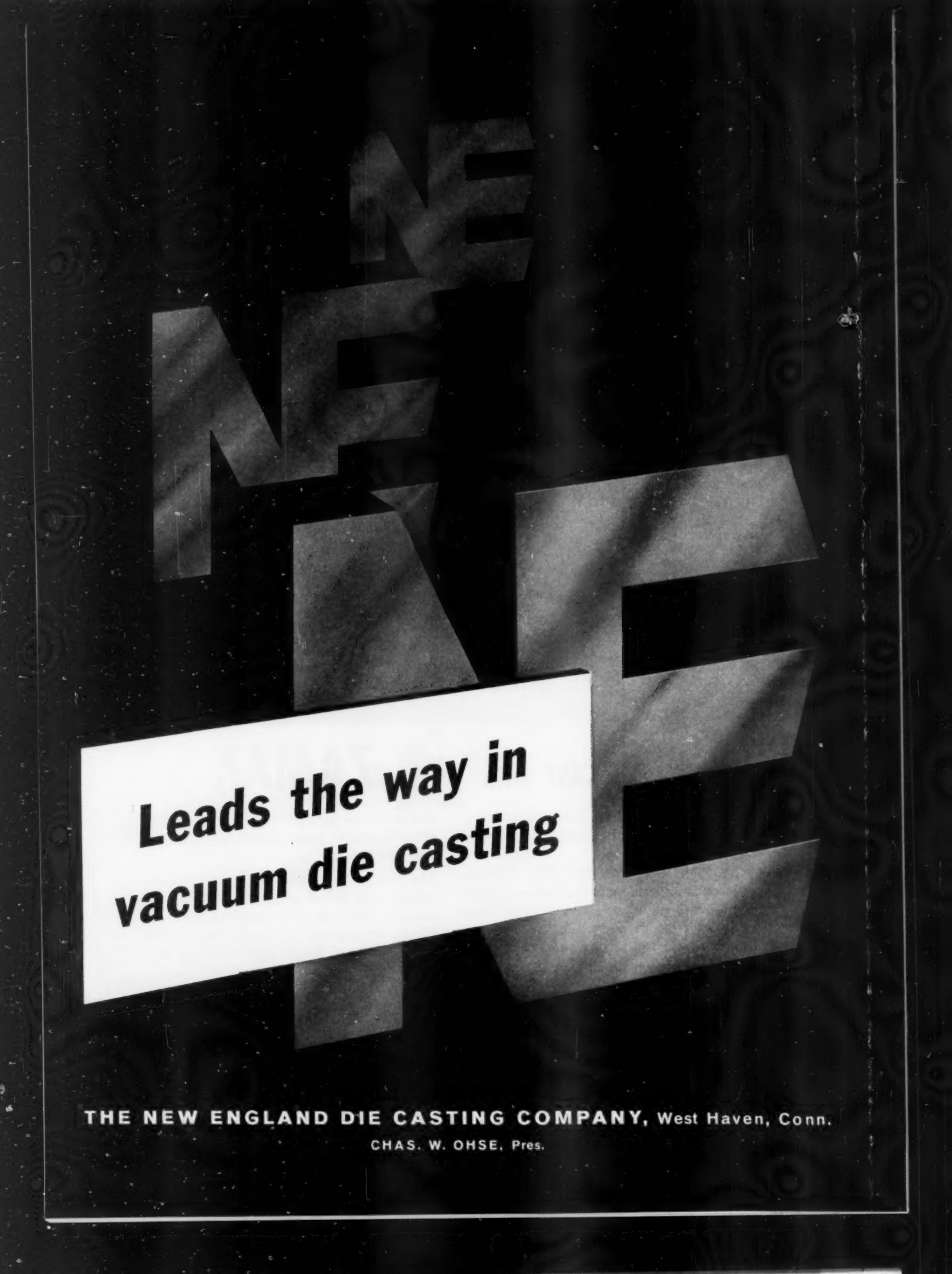

NE
NE
Leads the way in
vacuum die casting
THE NEW ENGLAND DIE CASTING COMPANY, West Haven, Conn.
CHAS. W. OHSE, Pres.

VACUUM DIE CASTING machines at Veeder-Root. Vacuum pumps are on a lower floor.

Development work pays off with . . .

VACUUM DIE CASTING

SPECIAL WINDOW on the die casting machines allow the operators to keep a continuous check on production performance. Vacuum seal can easily be broken to inspect the machine.

PRECISION AND SPEED in vacuum die casting zinc and tin are the result of 20 years' development work at the Veeder-Root Hartford plant. This plant was one of the first in the country to solve the problem of injecting the molten metal, opening the dies, ejecting the part, and transferring it to a hopper outside the machine—all without breaking the vacuum seal. Although this process was developed basically for the production of Veeder-Root precision counter components, it is well suited for casting many parts previously considered not suitable for die casting.

It is not expected that this process will replace ordinary zinc or tin die casting for parts not requiring exceptionally high accuracy and produced in low volume. However, it will offer tremendous savings where parts were formerly machined in order to get close tolerances.

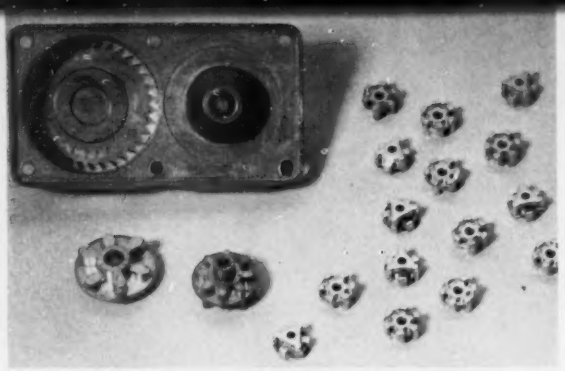
THE CASTING PROCESS

The entire die casting operation is done under a vacuum of 29½" to 30" Hg. The dies are closed mechanically. Electronic controls guarantee the proper positioning of the die before the metal is injected.

Upon completion of the casting cycle the castings are automatically removed from the die and ejected through a special device into a hopper on the outside of the machine. This is done without breaking the vacuum in the machine.

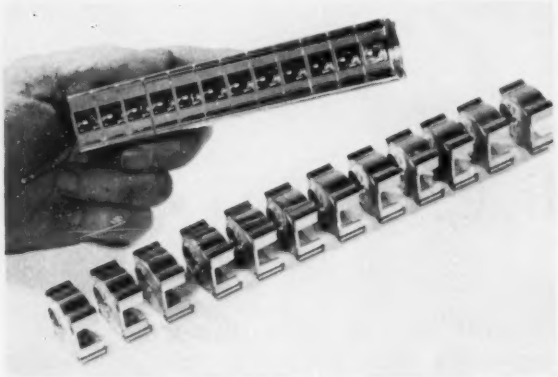
CASTING CHARACTERISTICS

Dense parts result from this careful vacuum casting operation. Also, surface smoothness is such that only superficial buffing is needed to produce a satin-silver or old pewter appearance. On the counter housings, ordinarily only a slight buffing of the top is all the finishing required. On smaller parts there is no evidence of flow marks or deterioration through aging. Table I lists the properties of the castings.

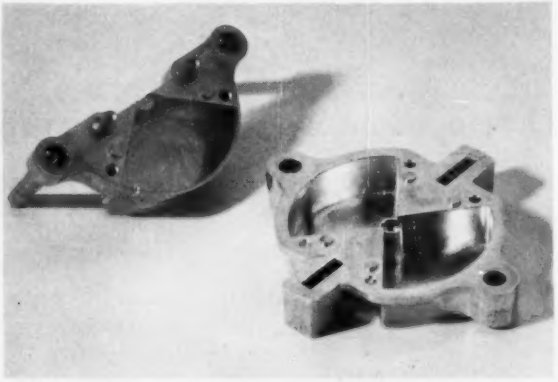


SMALL PINIONS, gears, watch cases, automotive, and electronic parts can be cast to eliminate expensive machining.

PRECISION HOUSING for a Veeder Counter, designed with intricate interior construction, produced by vacuum die casting.



IDENTICAL CASTINGS can be cast with such precision that a pressed fit enables one to hold a whole stack.



DAMPER CONTROL for air conditioning units is about the largest part castable on Veeder's machines. It is over 3" dia.

TABLE I Properties of Veeder-Root Vacuum Die Castings

	Veeder Metal #1	Veeder Metal #3	Type Metal	ASTM AG40A	ASTM AC41A
Density (lb/cu. in.)	0.26	0.26	0.35	0.24	0.24
Elongation	3%	1.5%	—	5%	3%
Yield Point (psi)	11,640	11,070	9,600	—	—
Hardness (Rockwell T)	15	13	–20 to –30	73	75
Melting Point (F.)	450-500	450-500	450-500	717.6	717.1
Shrinkage (in./in.)	0.002	0.002	0.002	0.011	0.011
Corrosion Resistance	Excellent	Excellent	Good	Good	Good

HIGH DIMENSIONAL STABILITY

The parts produced by this process can be held to tolerances of ±0.0005". Automatic operation does not affect accuracy. Inter-locking parts produced over 20 years ago before the machines were automated can be press-fit into identical parts being produced today.

In applications where vacuum casting was previously not considered for tolerance reasons, parts now are vacuum cast with excellent reproducibility over production runs of several million.

IMPORTANCE OF METALLURGY

The success of the Veeder process depends heavily on the purity of the metals being cast. All metals are analyzed spectrographically in addition to chemical and physical analyses. When zinc base alloys are used, tin content is below 0.001%.

DIES

Dies are ground, diamond lapped, and polished to provide the fine surface and minimum flash required in the Veeder process. Because of the precision with which the dies are made, castings can be stripped from the dies without distortion. Dies require practically no taper, and ejector pin marks are eliminated. On sidewalls a taper of only 0.005" per inch of sidewall is all that is required. Die life is long.

Modified nitriding gives . . .

AN IMPROVED DIE SURFACE

By H. K. BARTON, *European Editor*

ONE OF THE MOST common reasons for loss of profit in a die casting shop is down time due to malfunctioning.

Surveys in both European and American plants have shown that almost one-half of this down time is due to die maintenance. Nearly all of this down time can be avoided by proper die construction and proper lubrication of the die during casting.

In this article we will not touch on either die construction nor on lubrication in the ordinary sense of the word. Rather we shall discuss the surface treatment of the dies to give a more slippery surface and a surface which is highly resistant to soldering and galling.

The process is "Lubri-Case", a soft nitriding or second tempering carried out in a Cassel type salt bath at about 570°C (1058°F). The salt bath contains chemicals which produce an exceedingly thin case on the surface of the steel; (see Fig. 1). This case is less than 0.001" thick and is not very hard. Its feature is exceptional slickness. In fact, it has been found virtually impossible to produce galling, much less seizure.

Even when only one element of an assembly is treated, the protection against seizure is good. It is advantageous to have ejectors and sliding cores treated. Dowels bushings and finger-cams are of next importance.

Recent work has shown that treated cavities which were polished after Lubricasing tend to develop a higher quality "hardware finish" on the castings produced, and this finish develops more quickly.

What can be an even more important advantage was reported at the Third International Diecasting Conference this year. Swedish investigators showed that Lubricased cores showed increased resistance to heat-checking. This has been suspected for some time, but comparative data were lacking before.

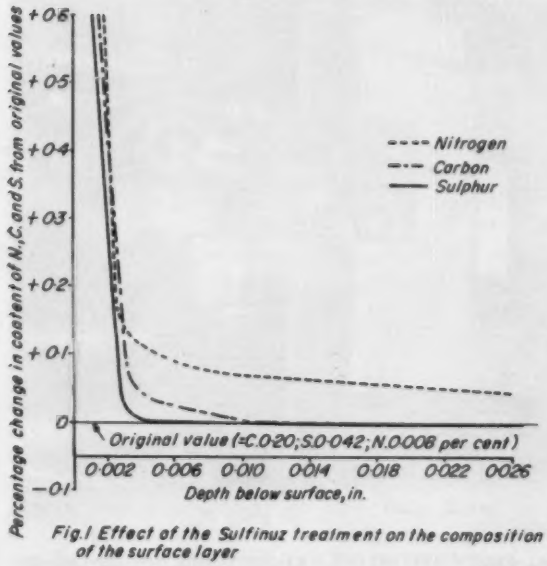


Fig.1 Effect of the Sulfinuz treatment on the composition of the surface layer

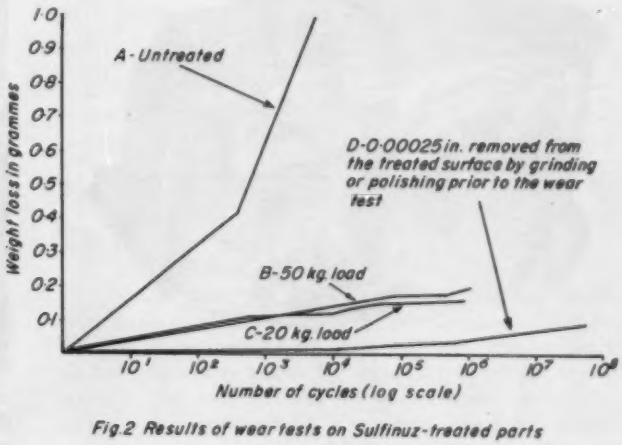


Fig.2 Results of wear tests on Sulfinuz-treated parts

If these early observations are born out in practice this surface treatment method could be a long step to solving one of die casting's most pressing problems. The indications are that downtime losses will be greatly reduced, service life of tools extended, and the quality of the die castings improved.

The following case histories illustrate the results which have been secured in some cases through the use of the Lubricase treatment. These results are entirely typical.

TREATMENT GIVES IMPROVED DIE LIFE

By R. POCHARD, *Societe de Carburateur Zenith Lyons, France*

In the plant of the Zenith Carburetor Company at Lyons, France, diecasting dies treated by the Lubri-Case process have now been operated for several years. As this is a captive plant producing specialty items, the number of new dies going into production is relatively small—much smaller than in custom plants—but the company has put into operation more than fifty Lubri-Case treated dies during the past four years.

More than half of these have been very intricate tools, producing bodies, air intakes and bowls for carburetors. Like all such diecastings, the Zenith carburetor parts require elaborate coring for their production, and because of the close limits that must be held, clearances of sliding cores in the die must be held to a minimum. In these elaborate dies, the company's practice has been to Lubri-Case all the tool parts. The remaining tools that have gone into production over the period—about twenty—have been of simpler design. In these, only the moving cores and ejectors have been Lubri-Cased.

Since this program started, no case of galling or seizure has occurred in a treated die, though this was a serious cause of downtime before Lubri-Case treatment was adopted. Loss of dimensional accuracy through frictional wear on rubbing surfaces, which also used to be a headache, has been virtually eliminated in treated tools. In fact, it is now possible to hold closer limits than ever before, because original clearances have been substantially reduced on Lubricased dies.

The company's introduction to the process was spectacular, and followed the commissioning in 1954 of a die to produce a two-chamber carburetor bowl, 32 NDIX. This is seen in Fig. 3. It is a zinc-alloy diecasting which is produced on a cold-chamber machine to assure maximum solidity. The trimmed weight is around 2 lb. 4 oz. This carburetor bowl has fifty cored holes of various sizes, entering the casting at a variety of angles to form the elaborate system of internal passages. Most of the external surface of the bowl is formed by a pair of sliding core-blocks, moving vertically and operated by hydraulic cylinders. The main features of this tool can be seen in Fig. 4.

This first tool was not Lubri-Case treated. It was constructed from a standard chrome-vanadium die steel and heat-treated in the usual manner. Production of the carburetor bowl began in May 1954, and

FIG. 3 CARBURETOR BOWL die cast in zinc alloy requires a complex die because of the fifty cored holes set at various angles.

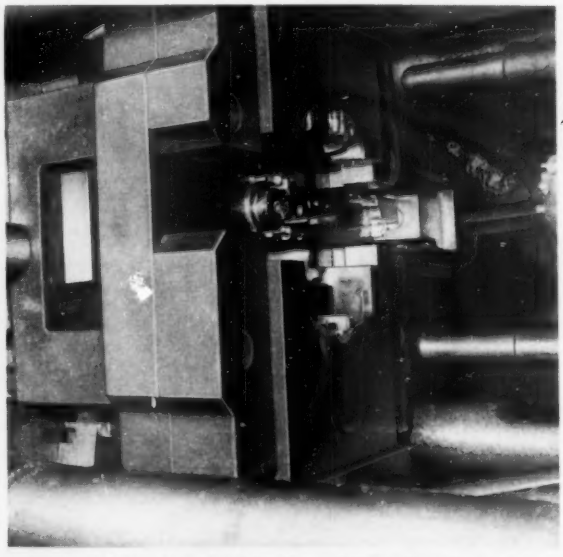


FIG. 4 DIE CASTING DIE for the carburetor bowl has two sliding core-blocks which move vertically to form external surfaces.

the die was finally taken out of commission in November 1955. During these eighteen months, 108,000 castings were made. Over the same period, the die went for repair twenty-seven times, due to the development of galling or, in some cases, because of actual seizure of the core-blocks in their housings.

Initially, a clearance of 0.006-in. was allowed for the main sliding blocks, but this did not suffice to prevent galling. Every time the torn surfaces were cleaned up, the clearance was increased until it was finally about 0.010-in. At this the dimensional accuracy of the casting—especially parallelism and alignment of cores—could not be held, so the effective life of the die was at an end.

Because of the unsatisfactory performance of this tool, a second die had already been under construction for some time when the first one failed. This was of the same steel and underwent the same heat-treatment, but all the pieces were then Lubri-Cased. In all significant respects the designs of the two dies were identical. However, the clearance of the sliding cores in their housings was *reduced* to 0.0032-in. The casting conditions for this die were unchanged, with the metal being injected at a point opposite one of the sliding cores. (Fig. 5).

The second die went into service in December 1955, and after producing 140,000 castings without incident was stripped down and checked dimensionally. The clearance in the slide housings, originally 0.0032-in., had increased by less than 0.0008-in. and the friction surfaces were in perfect condition when examined. In view of the unsatisfactory performance of the first tool, operating under identical conditions, this was considered outstanding testimony to the value of the Lubri-Case treatment.

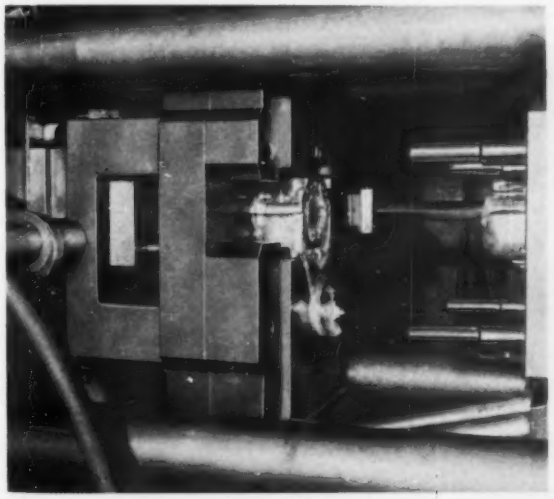


FIG. 5 LUBRI-CASE treated die has produced 30% more carburetor bowls than untreated die and shows negligible wear.

In the Zenith foundry, well over a million shots had been made in treated dies by the spring of 1959. Not only had every treated tool operated with complete freedom from galling or seizure, but operation of Lubri-Cased dies was found to be physically easier. This was attributed to the extra slickness of treated cores, which did not develop drags and offered appreciably less resistance to ejection than untreated ones. Because of this, castings could be ejected at a higher temperature and the whole operating cycle performed in less time.

PRODUCTION OF THE VERSAILLES CARBURETOR

By M. VEILHAN

When we undertook to produce the carburetor for the Versailles (a French automobile), the tool required was the most complex this company had ever constructed. The die was of RM2 Voeklingen steel and cost four million francs. Unfortunately, it never operated satisfactorily and had to be removed for repair every two or three thousand shots. There was a heavy flash, ejection was difficult and we had to make a 100% inspection of all the castings produced.

After making fifty thousand parts we took this die out of production: during the latter part of the run the machine was frequently stopped for two or three hours at a time while galled surfaces were cleaned up. We replaced it by a die of similar design, but in this case the cavity parts only were of high alloy steel. The rest of the tool was of cheaper material. All the die parts, however, were given the Lubri-Case treatment. At the time of writing, this die has already produced 50,000 castings without any sign of galling or any other trouble; ejection is easier and there is very little flash. It is hardly surprising that the company is now applying Lubri-Case treatment to all new diecasting dies before they go into production.

THESE TWO case histories are typical of the experience of European die casters who have used the Lubri-Case treatment on dies.

The main applications of Lubri-Case in the diecasting industry, drawing upon European experience as a guide, would appear to be the following:

1. Ejectors, guide pins, bushings, core-locking wedges
2. Sliding cores
3. Cavity inserts, large fixed cores
4. Main die blocks, ejector boxes, rack-and-pinion mechanisms
5. Plunger tips (records show life increased by a factor of fifteen or thirty over nitrided tips)
6. Rams for core-pulling and ejector cylinders.
7. Machine tie-bars and cylinder rams.

Broadly, these are placed in the order in which they have been shown to have the most immediate influence upon production costs, but new applications, as for example to trimming dies, hinge-pins for ingot-moulds and tension-bolts for goosenecks, are continually being explored by European diecasters. These minor uses do not show the same spectacular savings, but they all contribute to increased production.

Now...

BIG INVESTMENT CASTINGS / PART II

... how they are made

By HENRY LEFER, *Eastern Editor*

THE CERAMIC SHELL PROCESS, a new development in the investment casting industry, is used by the Arwood Corp. to produce exceptionally large stainless steel castings. These castings are up to 3½ feet long, weigh over 45 pounds, and can have ultimate tensile strengths of 200,000 psi.

Here is how a typical ceramic shell steel casting proceeds from blueprint to completed part.

ANALYSIS. An engineer, tool designer, and metallurgist study the blueprint to decide on the gating system and whether to use a machined or cast injection die.

SET-UP. A wax or plastic pattern is injected into the die. The wax for most of the injection machines is held in heated cylinders on the machines. However, Arwood has begun to convert to central wax systems, with the pattern material piped to the individual pattern casting machines.

If holes or intricate internal details are required, the pattern is injected around soluble wax cores or inserts. The desired internal coring is left in the pattern when these soluble cores are flushed out with water.

After the patterns are removed from the die, one or more are assembled with runner stock into a casting set-up.

BUILDING THE SHELL. The wax assembly is dipped into primary refractory ceramic slip and drained to get a thin uniform coating. Then it is covered or stuccoed with a fine refractory grain. The stuccoed assembly is dried in an area with controlled temperature and humidity for 1½ to 2 hours.

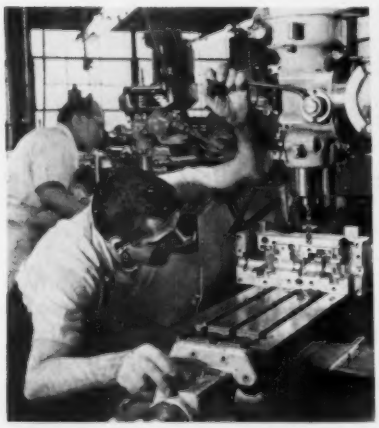
This process is repeated for as many as six layers using coarser-grain refractory. The completed shell is dried for 24 hours.

DEWAXING AND FIRING. The dried shell is flash-dewaxed, neck down, in 4 or 5 minutes in an 1800°F oven. Most of the wax melts and runs out. The remainder burns off. Then the shell is fired at 1600°F for 30 minutes. The shell is now ready for immediate use or can be stored indefinitely.

CASTING. If the shell has been stored, it is reheated before pouring. The shell is placed on a bed of sand and the metal poured from a 50-lb ladle.

PROCESSING AND INSPECTION. After cooling, the cast is placed on a vibratory table which shatters and shakes off the shell. The casting is then cleaned, cut off, heat-treated, and finished in the conventional manner.

Dimensions are checked with gages. Zyglo and Magnaflux inspections check for surface flaws. X-ray photos are taken to check internal soundness.

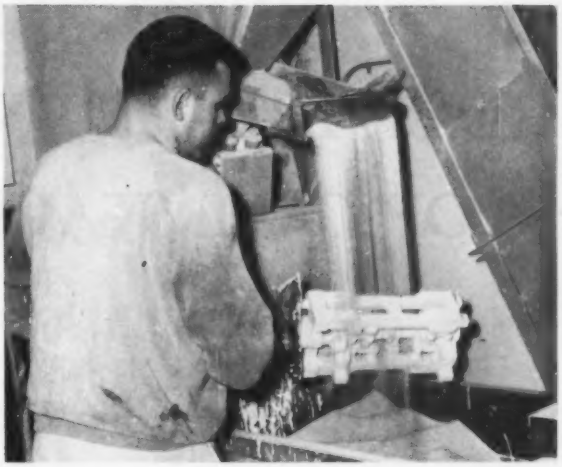


A TOOLMAKER machines the die into which molten wax will be injected.

WAX PATTERN is removed from the die and the soluble core is flushed out.

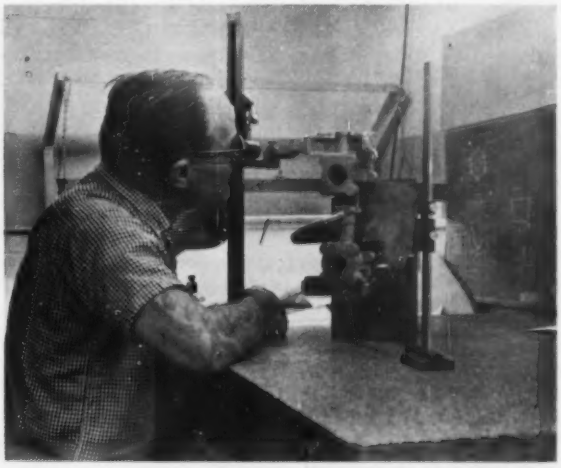
THE GATING SYSTEM is attached to the pattern by "wax-welding."

PATTERN and gating system is immersed several times in a slurry. This operation soon will be automated.

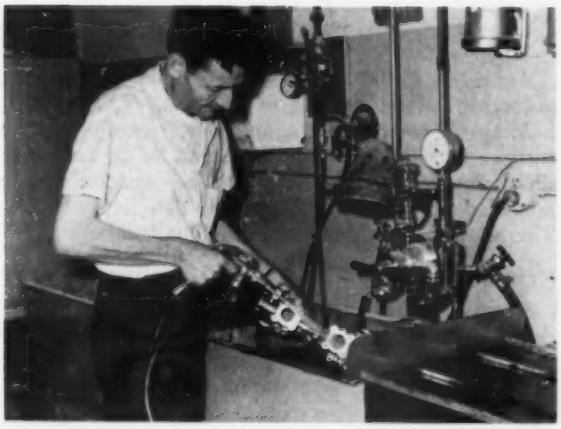


DIPPED PATTERNS are stuccoed with a finely divided refractory. This operation will also be mechanized soon.

THE SHELL is cast, using a vacuum assist to assure sound, dense metal. Pouring temperature must be controlled carefully



CRITICAL DIMENSIONS are checked. At the beginning of each production run, all dimensions are carefully checked.



FLUORESCENT penetrant inspection is used to check nonmagnetic alloys. Magnetic particle inspection is also used.

X-RAY INSPECTION checks for internal defects in the castings. Seven separate views were taken for this particular casting.

HEAT TREATMENT OF CAST STAINLESS STEELS PART I

By W. P. JAMES, *WaiMet Alloys Co.*

This paper is part of the Investment Casting Institute Intra-Industry Research Program.—Editor.

THE INVESTMENT CASTING PROCESS is well adapted to utilize the attractive properties of hardenable stainless alloys. Intricate castings can be made to close dimensional control, partially heat treated to a machinable condition for finishing, then hardened to high strength levels without distortion by low temperature aging and tempering treatments.

The hardenable stainless steels possess good properties at moderately elevated temperatures (up to 1300°F for some alloys), together with good corrosion and oxidation resistance. In recent years the development of precipitation-hardenable stainless steels has greatly expanded the use of these alloys for structural parts and jet-engine components in aircraft, and nonmilitary applications.

These newer alloys are not all castable. This report will be limited as much as possible to those alloys applicable to investment castings.

The hardenable stainless steels can be classified as martensitic, semi-austenitic or austenitic. The martensitic type can be further divided into straight martensitic and precipitation-hardenable martensitic steels.

The straight martensitic steels are best represented by Type 410, which will be discussed as a well-known material and basis of comparison for the newer alloys. Some of the commercially available precipitation-hardenable stainless steels are listed in Table I.

Part II of this report will discuss 17-4PH and Part III will cover AM-355, the currently popular castable alloys. There is potential interest in 17-10P and HNM for investment casting applications, but little if any work has yet been done with these alloys in cast form.

All other alloys listed in Table I have poor foundry characteristics, due primarily to their aluminum or titanium contents.

ALLOY COMPOSITION

Currently accepted composition ranges for these alloys are given in Table I. Most of these alloys are still in the development stage and changes in composition limits can be expected as more is learned about transformation behaviors and properties. The composition given for 17-4PH follows the newly restricted limits of the ICI FE-5(T) and proposed AMS 5355A specifications.

STRAIGHT MARTENSITIC STAINLESS—TYPE 410

This alloy contains chromium and carbon in such proportion that it undergoes thermal transformation from austenite to martensite, which is then tempered to the desired combination of properties.

Chemistry is relatively unimportant, although for maximum strength it is best to keep the carbon high and the chromium low. For maximum corrosion resistance the reverse is true.

Type 410 is not recommended where severe corrosion conditions exist but is generally satisfactory for applications requiring mild corrosion resistance. It offers very good resistance to scaling at high temperatures and has useful strength up to about 1200° F.

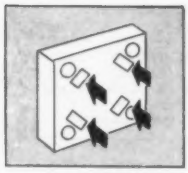
Actual transformation temperatures depend on the chemistry balance in the material. Heat treating procedures should be adjusted accordingly where this is important. Type 410 stainless becomes austenitic on heating at about 1500°F. On cooling, martensite begins to form at about 600°F, and the transformation is virtually complete at 350°F.

ANNEALING

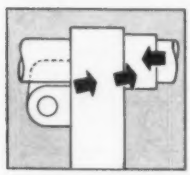
Annealing, or softening for machining, is normally accomplished by heating in the range 1550-1650°F, holding for several hours, and slowly cooling in the furnace to 1100°F. The castings can be air cooled at this point. Maximum hardness to be expected in the annealed condition is 175 Brinell (88 Rockwell B). The alloy is usually machined in this condition.

NORMALIZING

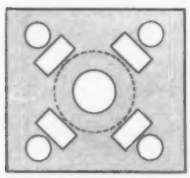
Normalizing to refine the grain size is sometimes desired. This treatment consists of heating to 1650-1700°F and air cooling. Higher normalizing temperatures up to 1850°F are sometimes helpful in improving low ductility values. Normalizing can be repeated for maximum refining and homogenizing effect on the cast structure.



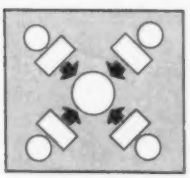
1. Each corner link is a strong, self-contained support for both plate and die.



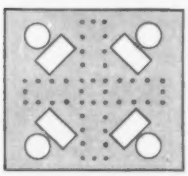
2. Short and direct transfer of loads on each corner minimizes bending stresses on the moving die platen and back plate.



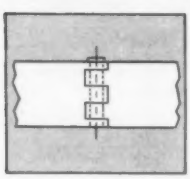
3. Reduces the area of unsupported moving die plate. Helps eliminate flashing and potential cracking of dies.



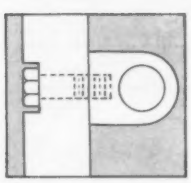
4. Prevents weaving of the link center axis (crosshead) and consequent unequal loading.



5. Permits a large area of both horizontal and vertical bumper pin ejection pattern.



6. Corner positioning of each link assembly results in equal and straight line loading of all pins and bearings in the link pivots.



7. Toggle anchors are bolted to the back and traveling platens. They are not subject to weld breaks or breakage as part of a casting.

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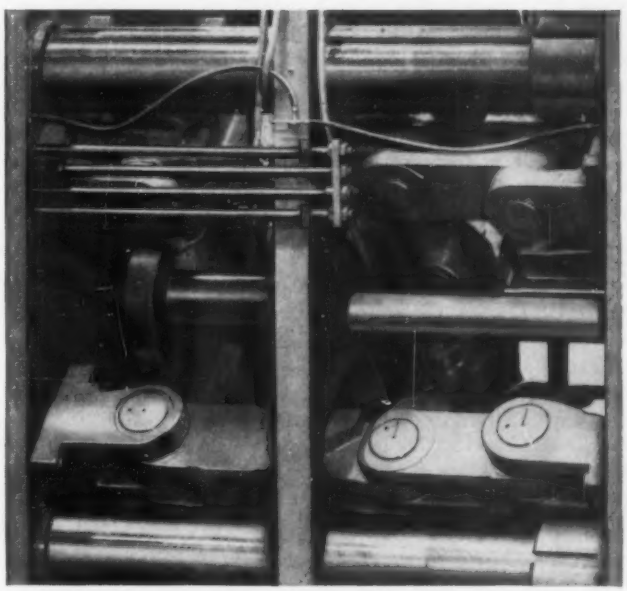
FOUR-CORNER LOCK-UP

in Greenlee–B&T die casting machines offers you 7 benefits



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HARDENING

Hardening after machining and/or normalizing, is accomplished by heating to 1700-1850°F, holding at least 30 minutes, and quenching in oil or air, depending on size of parts and handling convenience. Best results are usually obtained at the upper range of hardening temperature (1800-1850°F). A neutral salt bath is ideal for this treatment. Formation of martensite and consequent hardening occur during rapid cooling from the hardening temperature. Maximum hardness in this condition is about 48 Rockwell C.

TEMPERING

Tempering is a selective process dependent on the mechanical properties desired. The hardness value obtained by tempering quite accurately indicates the strength and dutility values. Tempered hardness is dependent on chemistry, structure, temperature, and time. It is meaningless to give specific test bar results unless all these factors are known. Duplicate heat treatments will not produce duplicate hardness unless composition and grain sizes are nearly identical.

Two dangers should be mentioned. Tempering temperatures between 700-1100°F are undesirable because they result in low impact strength values. This may not be important for some applications. The excluded range is often taken as 800-1100°F because attractive strength and ductility values can be obtained by tempering at 750-775°F.

PROPERTIES

The range of properties normally required for Type 410 in the hardened and tempered condition is given in ICI FE-4 specification. Included in this specification is a tensile strength of 180,000 psi at a hardness of 40 Rockwell C and 95,000 psi at 95 Rockwell B. All specified properties are typical and easily met. In normal practice the minimum strength and ductility limits will be easily exceeded. Since hardness can be varied over the entire range by suitable tempering treatments, the other properties are subject to a similar variation.

Excellent work has already been done with investment cast 410 stainless, so it is not necessary to quote actual tests in this report.

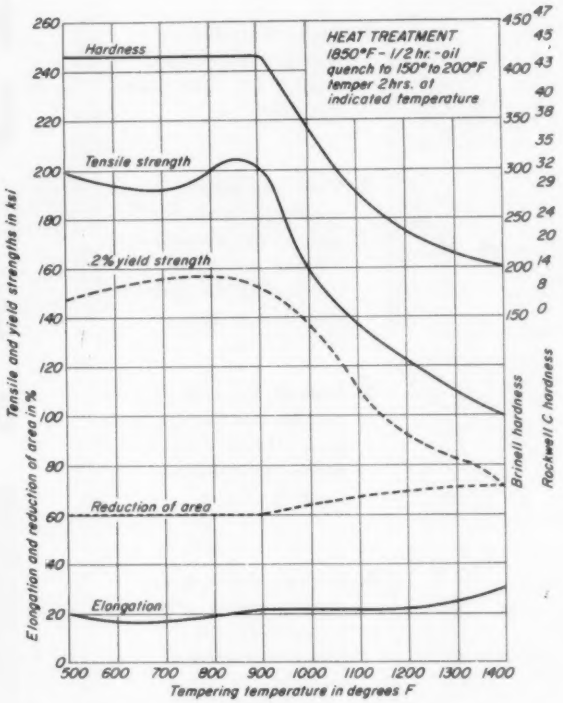

HEAT TREATMENT
1850°F - 1/2 hr. - oil quench to 150° to 200°F temper 2 hrs. at indicated temperature
Hardness
Tensile strength
.2% yield strength
Reduction of area
Elongation
Tensile and yield strengths in ksi
Elongation and reduction of area in %
Brinell hardness
Rockwell C hardness
Tempering temperature in degrees F

FIG. 1 EFFECT OF TEMPERING temperature on the average mechanical properties of Type 410.

TABLE I

Compositions of Hardenable Stainless Steels in per cent (Fe = Balance).

Alloy	C	Mn	Si	Cr	Ni	Mo	Cu	Al	Ti	Others
STRAIGHT MARTENSITIC										
Type 410	.05/.15	1.0x	1.0x	11.5/13.5	.50x	.50x	.50x			
MARTENSITIC, PRECIPITATION-HARDENABLE										
Stainless W	.12x	1.0x	1.0x	16.0/18.0	6.0/8.0			1.0x	1.0x	.20xN
17-4PH	.06x	.70x	1.0x	15.5/16.7	3.6/4.6		2.8/3.5			.05xN,
SEMI-AUSTENITIC										.15/.40 Cb+Ta
17-7PH	.09x	1.0x	1.0x	16.0/18.0	6.5/7.75			.75		
PH 15-7Mo	.09x	1.0x	1.0x	14.0/16.0	6.5/7.75	2.0/3.0		1.50		
AM-350	.12x	.50/1.25	.50x	16.0/17.0	4.0/5.0	2.5/3.25				.07/.13N
AM-355	.08/.15	.40/1.10	.75x	14.5/15.5	3.5/4.5	2.0/2.6				.05/.11N
										.15/.25 C + N
AUSTENITIC										
17-10 P	.15x	1.0x	1.0x	16.0/18.0	9.5/12.0					.20/.40 P
A-286	.08x	1.0/2.0	1.0x	13.5/16.0	24.0/27.0	1.0/1.5		.35x	1.9/2.0	.10/.50 V
HNM	.25/.35	3.0/4.0	.75x	18.0/19.0	9.0/10.0					.20/.30 P

x indicates maximum value.

METAL MELTING PRACTICES AT VOLKSWAGON

PART II Melting and Casting Aluminum

By GUENTHER SERWE, *chief engineer, Volkswagen foundries*
K. H. BROKMEIER, *chief engineer, Induction Furnace Div., Brown Boveri & Cie. AG*

Part I of this article appeared in last month's issue and discussed Volkswagen's melting and casting of magnesium.—Editor.

VOLKSWAGEN uses about 25 million pounds of aluminum castings and melts 3.5 million pounds of aluminum each year. This aluminum melting is done in line frequency coreless induction furnaces with rammed ceramic crucibles. Transport ladles and resistance heated holding furnaces, the latter using a gray iron crucible, ready the metal for mold castings. Aluminum is transferred from the holding furnace to the mold by manual ladling.

At this time the following equipment is in operation for processing aluminum:

8 aluminum line frequency coreless induction furnaces each having a capacity of 3500 pounds, 360 KW, maximum melting rate 1350 pounds per hour each.

50 electric resistance heated furnaces each 550 tons capacity, 24 KW.

8 die casting machines, 110 tons.

60 permanent molds.

MELTING INSTALLATION

Even though the furnaces are operated at 60 cycles, normal size ingots are used for starting the furnace from cold. It should be emphasized that this type of furnace can be switched on and off at will depending on the operating requirements. Keeping the furnace at temperature over weekends, holidays, etc., which is a must with the core type or channel furnace, is not required. The inherent bath agitation permits melting of small size material, such as chips, quite economically.

The forces which cause bath agitation are directed in such a way that slag is deposited on the surface of the crucible. There are, of course, no channels to be clogged. Depending on the amount of contaminants, the crucible must be cleared about once a week. The deposits on the surface of the crucible influence the melting process only in the sense that the actual crucible diameter becomes smaller, reducing the apparent rating of the furnace. The furnace is, however, not affected in its basic function.

With three-shift operation the life expectancy of the crucible lining is one year although in some cases a useful life of 2¼ years has been registered. The quality of the material used has a certain bearing on the lining life. In practice, however, greater stress is placed on a planned program of preventive replacement rather than on constant efforts to increase the lining life. An indispensable premise for a satisfactory lining life is good ramming and the proper drying and sintering process. At Volkswagen an automatic electric sintering device, which needs no attendance, is used for best results.

Electrically, an aluminum melting furnace is quite simple. Since each furnace is equipped with automatic power factor compensation and automatic temperature controls, the operator's duty is confined literally to "on" and "off" switching.

HOLDING FURNACES

The aluminum holding furnaces are of the non-tilting type and use electric resistance heating. As with the magnesium furnaces, bar type resistors are used for easy and quick replacement in the event of failure of one of the resistors. The crucibles are made of cast iron. A well-applied layer of cinder which is renewed or repaired weekly prevents any reaction between the molten metal and the cast iron of the crucible, and

no traces of iron can be found in the molten aluminum. Nor does the molten aluminum corrode the crucible. As a rule the cast iron crucibles are used for 120 to 140 working days. Cast iron crucibles lend themselves to optimum temperature conditions inside the furnace. Thermocouples inside the furnace frame and in the pour keep the temperature at a constant value.

POURING FACILITIES

The molten aluminum is ladled manually from the holding furnaces and cast in permanent molds into cylinder heads. Other smaller castings are produced in die casting machines rated 110 tons. Production of the cylinder head in the die casting machine is impractical due to the very irregular shape of this piece.

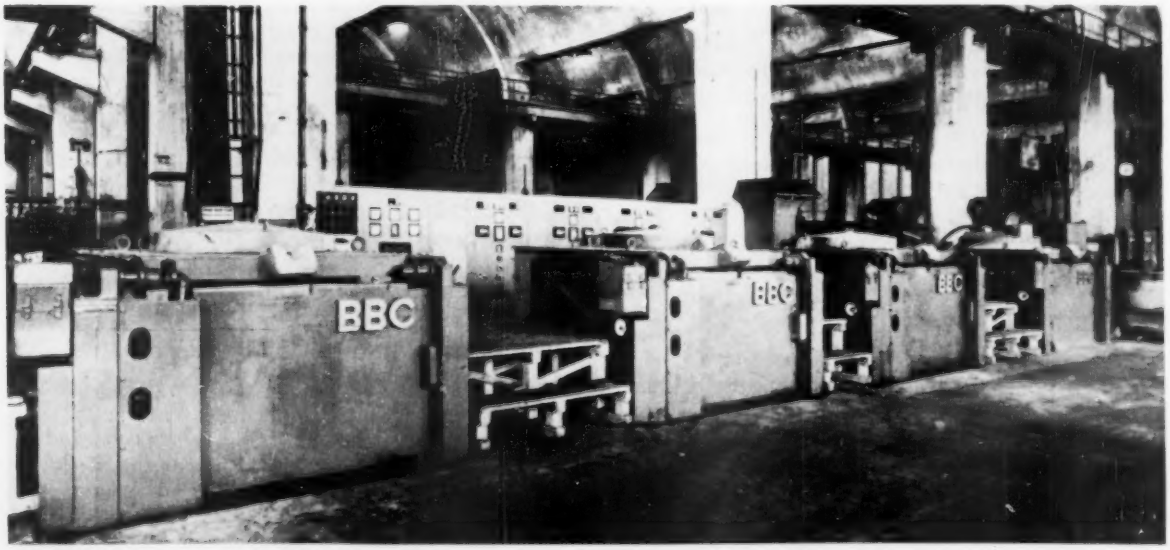
OPERATING EXPERIENCE AND ECONOMY OF OPERATION

Both the melting and holding furnaces have proved their value in large scale production operations since 1956. Important contributing factors have been the long life of the rammed crucibles of the induction furnaces and the negligible maintenance and supervision. The operation proved not only economical but also advantageous from the viewpoint of production. It should be stressed again that this type of furnace does not have to be kept at temperature during production stoppages. In this respect the coreless electric furnace is unique.

Because the bath agitation lends itself ideally to melting of chips and returns, chips incoming from the machining operation of cylinder heads are melted directly in the furnaces, with the resulting economy of the melting operation. Since the introduction of induction melting, the average annually computed metal loss of the aluminum foundry, referred to finished castings, amounts to 3%.

The average of energy consumption for melting amounts to 260-270 kWH/1000 lbs. The average power demand of the holding furnaces is 13 KW.

MOLTEN ALUMINUM being poured from a tilt-type melting furnace. It is stored in holding furnaces until ready to be hand ladled to die casting machines or permanent molds.



ALUMINUM MELTING FURNACES of the line frequency, coreless induction type at Volkswagen.

SINTERED STAINLESS STEEL POWDERS

PART I

By R. L. SANDS, *The B.S.A. Group Research Centre; and*
J. F. WATKINSON, *Director and Gen. Mgr., B.S.A. Metal Powders, Ltd.*

THE COMPACTING AND SINTERING behavior of stainless steel powders is influenced by their chemical compositions, according to previous investigations. Studies show that molybdenum, silicon, and possibly columbium adversely affect green density and increased the shrinkage during sintering.

In addition, studies have defined the alloy compositions which produce the most suitable properties.

Taking in to account the facilities presently available in the powder metallurgy industry, stainless steel powders intended for parts production must exhibit the following features:

- With pressing loads in the range 30-50 tons/in², they must give high green density and adequate green strength.
- Compacts must have high mechanical strength after sintering at 2100°F (1150°C) in dissociated ammonia. Shrinkage is limited to 1%.

This report describes work carried out to determine the properties of sintered material produced under these conditions, using the optimum compositions defined by earlier investigations. In addition, particular attention has been directed to the compressibility and green strength of the powders and to the influence of adding a lubricant. Three powders of the 18: 8 type and one hardenable type were investigated.

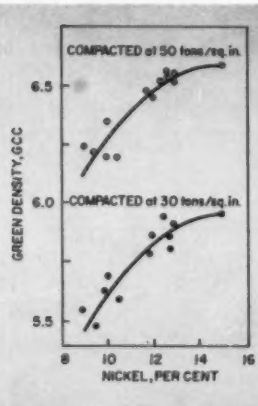


FIG. 1 Influence of nickel content upon the green density of 316L. No lubricant was added.

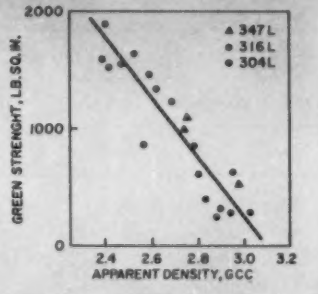


FIG. 2 Influence of apparent density upon the green strength of stainless-steel powders compacted at 30 tons /in². No lubricant was added.

EXPERIMENTAL DETAILS

Specimens, either 2 x ½ x ½ in. or 2 x ½ x ¼ in., were compacted in a "floating" die-set, and sintered in small tube furnaces (impervious recrystallized alumina tubes). Dissociated ammonia was led directly from a "cracker" to the back of the furnace tube and then allowed to circulate freely over the specimens. All the specimens were sintered for 1 hour only, the temperature being controlled within ± 18°F (10°C).

Tensile-strength determinations were carried out in a Hounsfield tensometer on specimens 0.178 in. dia. having a gauge-length of 0.632 in. A three-point bending test (transverse rupture test, outer loading pins 1 in. apart) was used to obtain the green and the sintered bending strengths (maximum fiber stress)*. Linear shrinkage and density were measured on the 2 x ½ x ½ in. blocks, before and after sintering.

A die lubricant consisting of a saturated solution of stearic acid in alcohol was used, except when lithium stearate was mixed with the powders. Lithium stearate (–300 mesh powder) was blended with the powders for 4 hours before compacting.

RESULTS AND DISCUSSION

Table I gives the chemical composition of the four powders studied. The particle-size distributions determined by sieving, the flow rates, and apparent densities are given in Table II.

The results in Table II are typical of current stainless-steel powders intended for parts production, the quantity of –300 mesh powder being about 40-50% of the total weight, and the apparent density fairly low. This is indicative of an irregular particle shape.

GREEN PROPERTIES

In Table III the relationships between the brands of the powders and their green properties are shown. Results for specimens compacted at 30 and 50 tons/in² are given, and the influence of lithium stearate upon green properties is shown. (The values in Table

*See MPIF Standard 15-51T for details of the test conditions.

TABLE I — Chemical Composition of the Powders (wt.-%)

Brand of Powder	C	Mn	Si	Cr	Ni	Mo	Nb
304L	0.03	0.06	0.65	18.9	10.5	0.02	Trace
316L	0.04	0.07	0.74	18.3	13.2	2.23	Trace
347L	0.02	0.09	0.57	17.8	13.4	0.07	0.40
410L	0.13	0.15	0.69	12.8	0.53	0.02	Trace

TABLE II — Particle-Size Distribution (wt.-%), Flow Rate, and Apparent Density

Brand of Powder	Particle Size,						Flow Rate, g/sec	Apparent Density, g/c.c.
	+147	147-104	104-74	74-52	52-37	-37		
304L	Nil	7.7	17.0	23.8	23.6	27.9	1.34	2.61
316L	0-4	16.0	20.1	11.5	18.4	33-6	1.27	2.72
347L	Nil	9.8	29.0	15.4	19.9	25.9	1.35	2.59
410L	Nil	4.0	16.3	21.5	27.0	31.2	1.28	2.69

III have been interpolated from plots of green properties against compacting pressure, with the exception of the values for unannealed 410L powder, which are experimentally determined values).

All the austenitic powders possess good pressing characteristics. The influence of nickel content upon the green density of 316L is shown in Fig. 1. Raising the nickel content from 8 to 13% completely offsets the deleterious effect of molybdenum upon green density. Whether the influence of silicon upon green density can be counteracted by nickel in a similar way is not known at the present time. There is also some indication that raising the chromium content above 18% somewhat reduces compressibility, and this probably explains the slightly low green density of the 304L powder compared with the values normally obtained. High green densities and strengths were obtained from the 410L powder, provided that the material was annealed before compacting.

Although a dependence of green strength upon green density was noted, the principal factor influencing green strength is particle shape, of which apparent density and flow rate are measures (assuming a constant size distribution). Fig. 2 shows the relationship found experimentally between green strength and apparent density, for many melts of powders. It is clear that in general the 316L powders tend to have low apparent densities which are reflected in higher green strengths. However, if the production of the 304L and 347L brands is controlled to give low apparent densities, high green strengths can be obtained, as shown in Table III.

Part II of this report will discuss the sintered properties and the effect of coining.

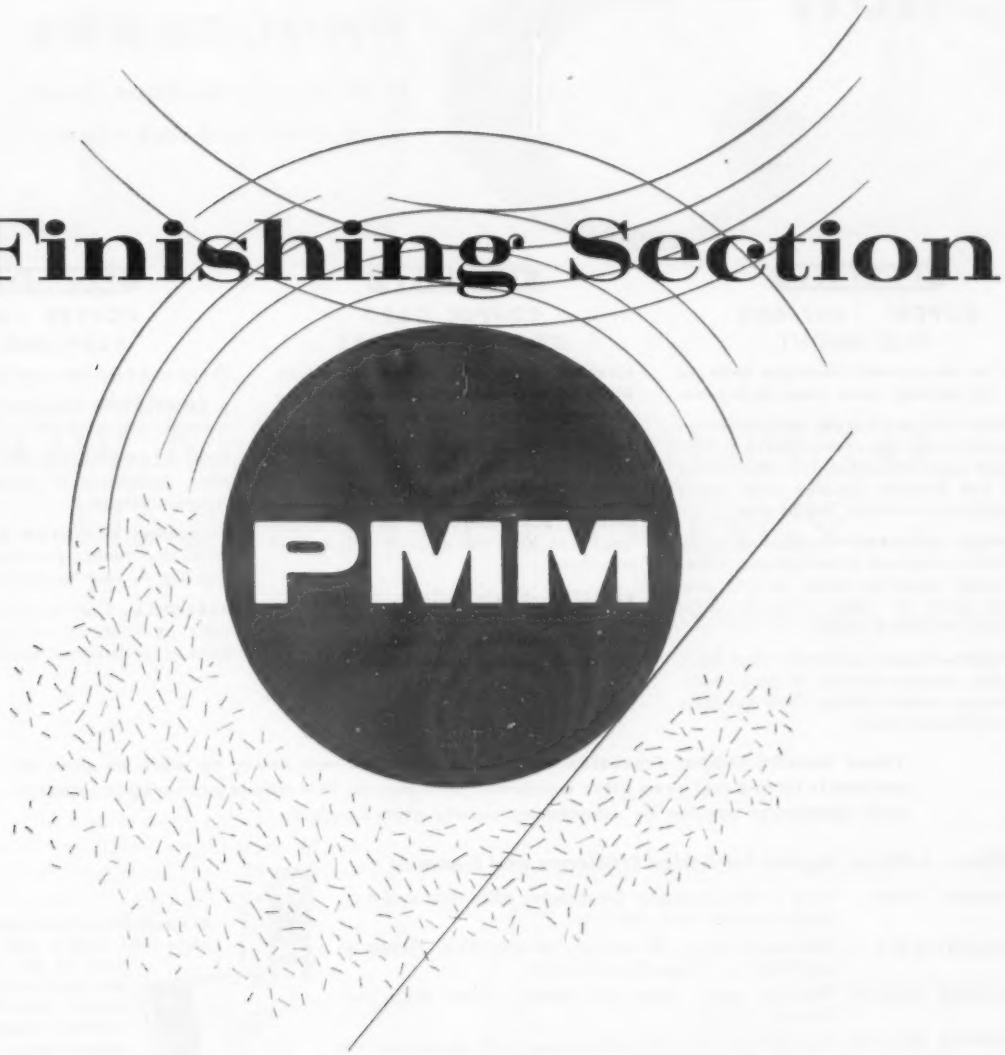
TABLE III — Green Properties of the Powders

Powder Type	No Lubricant Added				½% Lithium Stearate Added			
	Compacting Pressure, tons/in²				Compacting Pressure, tons/in²			
	30		30		50		50	
	G.D.*	G.S.†	G.D.	G.S.	G.D.	G.S.	G.D.	G.S.
304L	5.75	900	6.35	2600	6.05	240	6.60	900
316L	5.95	1500	6.55	4000	6.30	500	6.80	1500
347L	6.00	1300	6.65	3000	6.20	310	6.75	850
410L: (a) annealed	5.85	1000	6.55	2950	6.00	200	6.55	720
(b) not annealed	4.96	303	5.59	930	5.27	Nil	5.82	241

†G. S. = green strength, lb/in²
*G. D. = green density, g/c.c.

The specialized finishing methods, equipment and materials used to machine, assemble, surface condition or surface coat precision metal molded parts are presented here. This includes all secondary operations which convert a raw casting to a finished product.

Finishing Section



HOW KEYSTONE CAMERA CO. FINISHES DIE CASTINGS ..Page 45

IMPROVED CORROSION RESISTANCE .....Page 47

LOOK FOR THE DIAMONDS—SIGN OF FINISHING QUALITY

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ISOBRITE® COPPER #607-622 FULL BRIGHT

Best for high-speed, full-bright finish on zinc die castings, steel, brass or bronze.

CONSISTENT MAXIMUM BRILLIANCE—Primary agent suppresses burning, secondary agent operates well in medium and low current density area; both contribute to overall brightness.

COMPLETE COVERAGE—Covers extremely well in low current density areas. Ideal for parts requiring deep throw; produces plate in deep recesses comparable to buffed areas.

ECONOMY—Plates uniformly over high and low current density areas to save on copper consumption. Easy analysis for brightener level.

ISOBRITE® COPPER #623 GENERAL PURPOSE

Ideal for shops with varied operations. Gives full or semi-bright plate on zinc base die castings, steel, brass or bronze.

EASY-TO-USE—A single addition agent for rack or barrel plating. Easily controlled for desired brightness level.

HIGHLY ECONOMICAL—Use as semi-bright at half the cost of full bright solutions.

VERSATILE—Easily buffed to cover wheel marks. Also brightens well in areas not easily accessible to buffing. Use in rack or barrel plating operations.

ISOBRITE® COPPER #625 BUFF BRIGHT

Produces a very soft plate for quick buffing.

A COMPLETELY ORGANIC SYSTEM—No metallic constituents.

VERY ECONOMICAL—Works well over wide variations of temperatures and concentrations.

EXCELLENT FOR STOP-OFF—Produces plate that resists penetration by heat-treating or case hardening.

VERSATILE—Use in cyanide solutions with or without tartrates, Rochelle salts or proprietary substitutes.

These Isobrite Copper Processes contain no lead and are ready to work as soon as current is turned on, even after week-end shut downs. This means increased production and substantial savings by eliminating poorly plated rejects.

Auxiliary Addition Agents for Added Efficiency and Economy

ISOBRITE #630	Aids anode corrosion for greater efficiency and produces finer grained deposits.
ISOBRITE #631	Chrome reducer. Wide range of operation. Forms no undesirable breakdown products.
ISOBRITE #627-W	Wetting agent. Non-ionic surface agent with low-foaming action.
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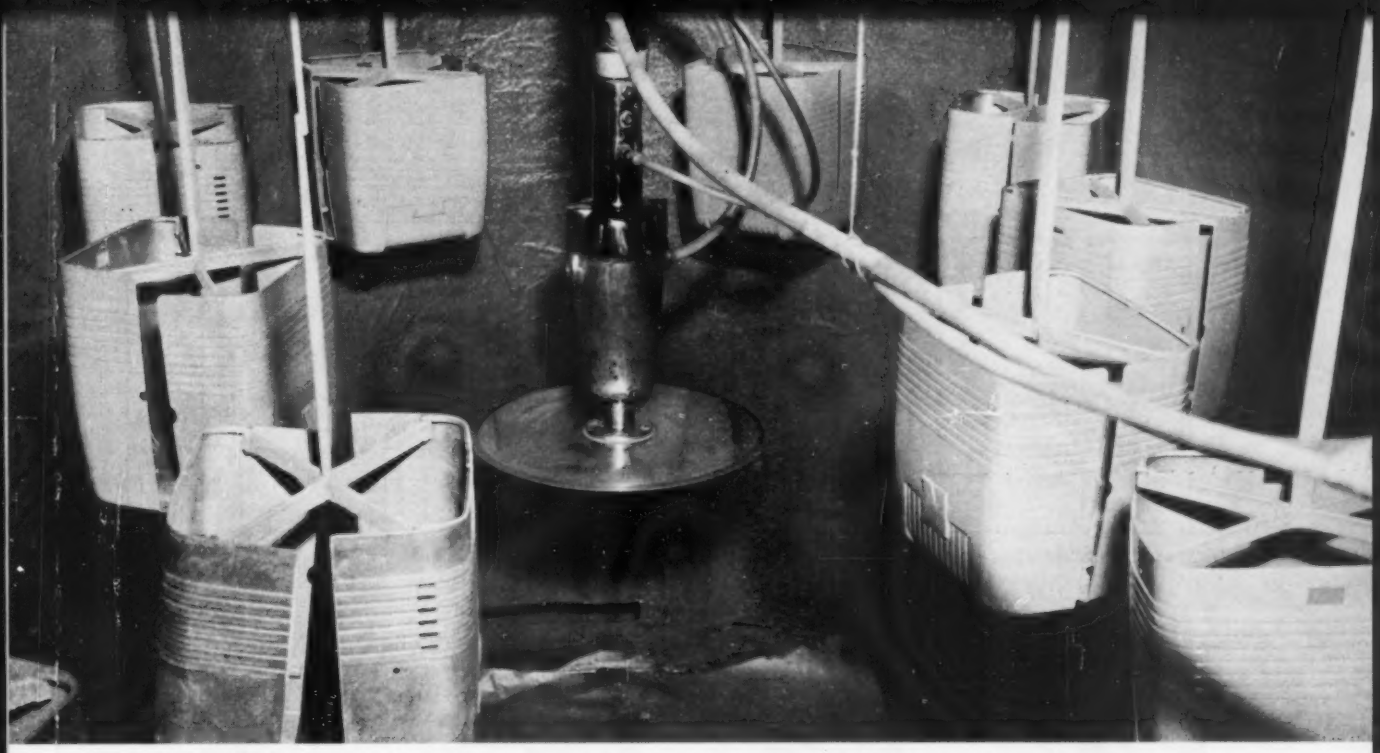


MOVIE PROJECTOR covers are painted by an electrostatic spray painting process at the Keystone Camera Company.

HOW KEYSTONE CAMERA CO. FINISHES DIE CASTINGS

. . . with electrostatic spray painting

THE PRINCIPLE of electrostatic spray painting is based on the attraction of highly charged paint droplets to electrically grounded objects. This is similar to the way a magnet attracts iron powder. Therefore, if highly charged paint droplets are sprayed in the general direction of a grounded object, they head straight toward that object. In fact, most of the droplets which overshoot their target turn and come back to it.

For this reason electrostatic spray painting offers these advantages:

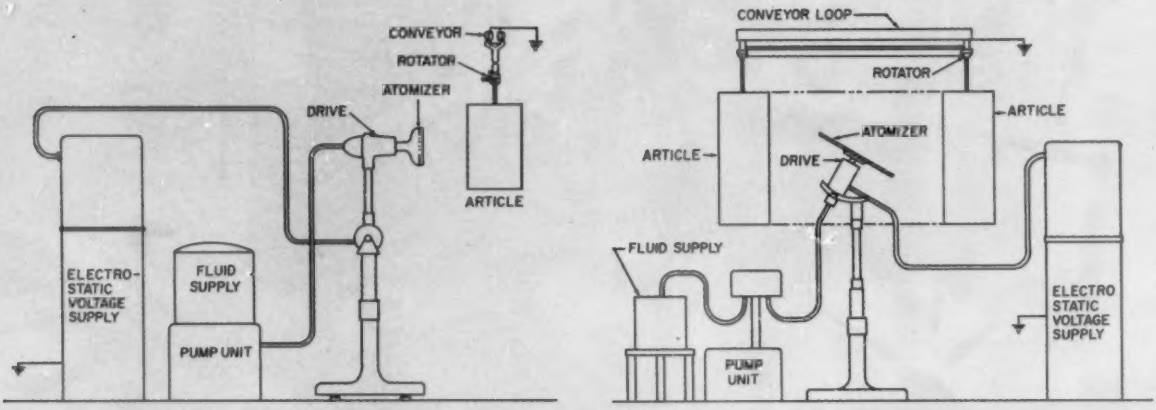
- Less paint is used.
- Production is faster, less labor is needed.
- Coatings are more uniform.
- Rejection rates are lower.
- Less painting equipment is needed, maintenance costs are lower.

The electrostatic system uses less paint because nearly all the paint used is deposited on the intended objects. Some installations get 5 times the coverage of compressed air spray painting. The process also shows appreciable savings over dip and flow coating.

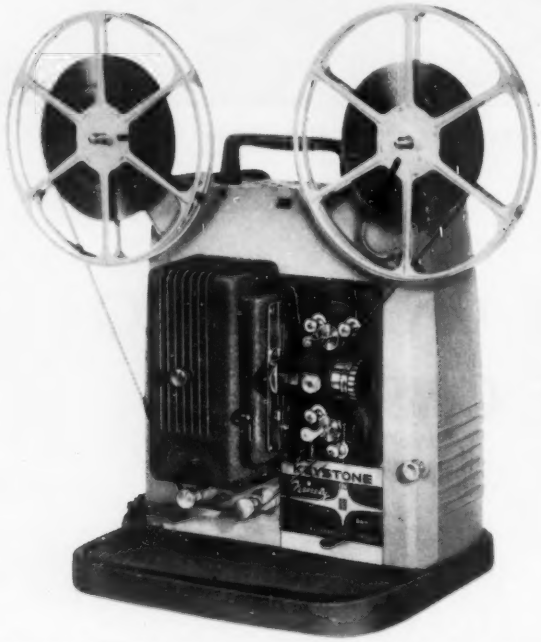
Since the electrostatic system is nearly 100% efficient and is easily automated, production is much faster. It often eliminates the multi-shift operation of large painting crews.

The more uniform coatings and lower rejection rate are due to the elimination of the major variables of air spray methods. Also, the paint seeks out shielded areas. The operator needn't contend with atomizing air pressure, spray pattern size and shape, overspray exhaust currents, or accidentally leaving some areas unpainted. This frees production painting from dependance on the art and skill of operators.

Since there is almost no overspray, no water washed walls or equipment for collecting wasted paint is needed. Ventilation of the painting area is necessary only to exhaust solvent fumes. This means much less air flow is needed for ventilation. No compressed air equipment is needed, and there's less maintenance and clean-up expense.



SCHEMATIC DIAGRAMS of electrostatic spray systems show the bell-type (left) and the disk-type (right) atomizing systems.



BETTER FINISH with fewer rejects resulted when Keystone switched to electrostatic spray painting for this movie projector.

HOW IT WORKS

In the Ransburg No. 2 process, an electrostatic spray painting method, articles to be painted are carried around a disk-type atomizer by a conveyor. The atomizer rotates so that paint which is pumped to it is thrown off the edge. Also, the atomizer is charged to about 100,000 volts above ground potential. This high charge is transferred to the paint. Since particles of similar charge repulse each other, the paint atomizes into a fine mist as it is thrown off the disk.

The objects to be painted are at ground potential and exert a strong attractive force on the charged paint mist. This attraction increases as the droplets approach the objects. This is why there is almost no overspray.

The amount of paint deposited is controlled by adjusting the speed of atomizer rotation, the rack movement, the rate of paint feed, and the voltage drop between the atomizer and racked parts.

The plane of the atomizing disk can be at any angle to the painted articles. The disk can also be moved as it rotates for specific types of coverage.

Besides the automatic systems, there are also electrostatic hand guns which work on the same principle.

KEYSTONE CAMERA SPEEDS PRODUCTION

Electrostatic painting solved Keystone Camera Company's production scheduling problem and lowered their rejection rate.

Demand for Keystone's home movie equipment becomes heavier around Christmas. The painting department became a production bottleneck late each year in spite of heavy overtime.

The installation of a Ransburg No. 2 system cured this. Now more parts are painted in an hour than were formerly painted in a day.

The case and covers for the cameras and projectors must match. Therefore, uniformity of finish and color consistency are important. Rejects averaged about 7% with hand spraying. With electrostatic spraying the rejection rate has dropped to less than ½%.

PAINTING PROCESS

This is the electrostatic spray procedure used at Keystone:

- Parts are degreased, etched and rinsed.
- Parts are loaded on racks and placed on a conveyor.
- The conveyor carries the parts past a Ransburg reciprocating disk-type atomizer.

Loops in the conveyor system provide for adequate flash off. This permits a maximum build up of wrinkle material.

- After painting, parts continue on the conveyor to gas-fired convection ovens. A high-quality wrinkle finish requires a long bake.
- After a conveyorized cool-off cycle, the parts are unloaded and inspected.

Parts requiring a gold overspray over masked areas are trucked to a handpainting department, while other parts are taken to the assembly department.

IMPROVED ANODIZING OF ALUMINUM EXTRUSIONS

By CHARLES C. COHN, *Director Research & Development, Colonial Alloys Co.*

THE CORROSION RESISTANCE of an anodized film need not depend on its thickness if it is properly after-treated or sealed. This report describes the after-treatments and seals that produce highly corrosion resistant thin anodized films. For example, films of 0.00008" can have very high corrosion and wear resistance, when sealed by this method. This corrosion resistance now includes resistance to alkali corrosion, previously not available.

Although this report deals directly with the anodizing of aluminum extrusions, the data pertains to aluminum and its alloys in general.

DRAWBACKS OF HOT WATER SEALING

Hot-water sealing has not proved to be reliable and consistent for corrosion and abrasion resistance. The mechanism of hot water sealing is based on swelling and insolublizing the aluminum oxide film particles. Thus the pores between the particles become smaller, impeding the entrance of corrosive materials into the pores. After hot water sealing the pores are not completely closed or sealed. Also, the swollen aluminum oxide particles are not homogenous, but consist of several types of boehmite, one of which has little corrosion resistance. For any degree of corrosion resistance of films sealed by hot water, the films must be of substantial thickness.

Furthermore, hot water (or steam) sealing for over 20 minutes is not recommended because it softens the outside of the film and also because of the corrosive reaction within the pore. But it takes hours of sealing time to more fully convert the aluminum oxide to the swelled aluminum hydrate.

The ageing of a hot water sealed anodized film has shown to be inconsistent in its corrosion resistance properties. Pick-up of moisture was observed, as well as inconsistencies in resistance to staining.

Anodized films sealed with a hot solution of a chromate have much greater corrosion resistance, but these materials color the film a yellow or orange. This is not acceptable where clear anodizing is desired.

Anodized aluminum can also be sealed with hot solutions of silicates, but these have the disadvantages of staining or dulling the film. The corrosion resistance has some superiority over the hot water sealed films, but it does not represent a material improvement.

NEW TECHNIQUE USES DUAL ANODIZING AND SEALING

It has been found that the corrosion resistance of sulfuric anodized films is greatly increased by again anodizing as a second step in a dilute solution of chromic acid at low voltage for about 1 minute.

The film porosity may then be sealed off completely by treating the film in a special hot aqueous solution, to precipitate a clear insoluble material into the film. This results in a clear, uniform, highly corrosion resistant product.

A second seal in the hot aqueous solution precipitates a clear insoluble material in and on the film to give it alkali, salt-spray, and outside environmental resistance.

Of prime importance in making use of the three treatments outlined above, is that the anodized film need not be thick (as in hot water sealing) to result in high corrosion resistance. Instead of a film thickness of 0.0003" or greater with a hot water seal, a film thickness of 0.0001" or less is satisfactory. Therefore, the 0.0001" or less film can be produced in ⅓ or ¼ of the time required to produce 0.0003" film.

Not only can production be increased three or four-fold, but the thinner film also has the following desirable properties:

- It is clearer and more reflective since the thicker film has less reflectivity.
- It is harder at its outside surface.
- It is more flexible. This is a characteristic of thin films versus thick ones.

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IMPROVED CORROSION AND WEAR RESISTANCE

In outdoor environments and in many conditions of indoor environments, abrasion or wear is accompanied by corrosion. A given coat which could withstand a high abrasion test, might fail in ½ to 1/10th the time, if a corrosive environment is present. And a corrosive environment is certainly constantly present in outdoor applications in the automotive and architectural fields.

The actual effect of corrosion on abrasion or wear resistance is illustrated by the powdering of corrosion pinpoints or spots long before the uncorroded portions of the film corrode.

A simple test of applying a corroded and uncorroded anodized film against a high speed dry cotton buff wheel points up the comparison.

Films of 0.0001" thickness, based on using the proper treatment and sealing techniques are far superior in these tests to films 0.0003" to 0.0004" thick, sealed with hot water.

A high degree of salt spray and alkali resistance was imparted to a thin (0.00008"), medium (0.0003"), and thick (0.0004" to 0.0005") films, when the dual sealing technique was applied, with or without the chromic acid anodizing step.

Salt spray resistance was based on the use of the 20% sodium chloride test, the 5% acidified salt spray test, the CASS test, and actual exposure in seashore areas. Actual exposure in industrial areas gave correlating results.

Alkali resistance was based on actual exposure to an aqueous solution containing caustic soda and to actual exposure to highly alkaline car washes, cement, mortar, and dishwashing detergents.

The high corrosion resistance occurred in dyed and pigment-colored anodized films and in clear films.

ETCHING TECHNIQUE

Deep etching, as in caustic soda etching, lowers the corrosion resistance of an anodized film and may affect the metal's fatigue resistance and ductility.

Since etching is primarily done to achieve a particular surface-finish effect, etching baths that have a tendency of smoothing, while etching, are better. Operating acid chemical polishing baths under proper conditions can achieve this. Uniform caustic etching is also of prime importance to achieve a uniform anodized film.

A proper etching sequence is to degrease first, acid-deoxidize, and caustic etch or anodize. Degreasing may be done by (a) vapor degreasing (or other organic solvent), (b) emulsion degreasing (a solvent diluted with water), or by (c) emulsifiable degreasing. The most effective methods are vapor degreasing and emulsifiable degreasing. Emulsifiable degreasing seems to be the most economical and requires no special equipment. However, its solvent should be one of high flash point (over 170°F.) without sacrifice of grease solvency. Also, it should be non-toxic. The only disadvantage of emulsifiable degreasing is the need for a spray and dip-flow rinse in some cases.

After the degreasing operation, the aluminum should be treated for about 1 minute in an acid deoxidizing solution to remove scale and oxides. This bath can be cold and its composition based on sulfuric-chromic acid mixtures. In more recent types chromic acid is substituted with a special compound.

The deoxidizing bath can serve as a desmutting bath, after caustic etching. But it has been a practice, in some cases, to remove caustic etching smuts in the anodizing tank. This is not considered the best practice.

For highly reflective finishes it has been the practice to buff or polish the aluminum surfaces, chemically brighten them, and finally anodize and seal them.

POLISHING METHODS

The appearance of an aluminum surface under the microscope reveals a very irregular surface of peaks and valleys which look smooth to the naked eye.

Mechanical polishing cuts off parts of the peaks and also flows over some of them. While to the eye the surfaces are mirror brilliant, actually they are a heterogeneous mass of metal crystals, containing embedded oxides, buffing compounds, etc.

Anodizing coats the basis aluminum, but in doing so it dissolves some of the aluminum surface. This results in a comparatively dull surface by exposing crystals subjected to mechanical polishing.

Chemical polishing, unlike mechanical polishing, dissolves the surface metal layer by removing the microscopic metal peaks faster than the metal valleys. This creates a smoothing and mirror polishing effect. Anodizing after chemical polishing retains this mirror-like surface and results in a high degree of reflectivity and corrosion protection.

Caustic or acid etching does not create a smoothing or brightening effect. Instead it follows the contour of the metal peaks and valleys, sometimes even accentuating them by anodizing.

Chemical polishing prior to anodizing is better for optimum surface appearance and specular (mirror type) reflectivity.

By varying the temperature of a chemical polishing bath beautiful diffuse reflective effects can be obtained which are hard to get by other methods.

PERMITS WIDER BATH LATITUDES

The dual anodizing and/or the dual sealing sequences described above permit much wider latitudes in the sulfuric acid anodizing bath.

Since thinner coatings as well as the thicker ones can be used, and less anodizing time is required to produce the thinner coatings, then:

(a) Electrolyte temperatures are not as critical. Instead of 70°F. (± 2°F.), temperatures in the range of 80°F. may be used.

(b) At a higher electrolyte temperature less voltage is required to maintain a given current density and less heat is generated by anodizing.

(c) At a higher electrolyte temperature more flexible coats occur, an important item for extrusions which have to be bent or formed.

(d) Current densities may be lowered from 12 to 8 amperes per sq. foot. This allows 50% greater load in the bath without sacrificing the corrosion resistance of the coat.

(e) Certain seals other than hot water make the sealing operation less critical and require less time.

USEFUL LITERATURE, CATALOGS, MANUALS

Qualified readers may obtain any of these technical publications by circling the numbers on the Reader Service Cards facing Page 58

PROCESSES

73 **Investment Casting**—PRECISION FOUNDERS INC. Brochure lists complete investment casting service from tooling to the finished part.

146 **Permanent Mold Castings**—FELTON ALUMINUM CO. —8-page facilities brochure of services offered for aluminum and magnesium castings, less than an ounce to 75 pounds.

147 **Investment Castings**—MISCO PRECISION CASTING CO.—External house organ tells how investment castings are used in aircraft structural applications.

148 **Extrusions**—ALUMINUM EXTRUSIONS, INC.—Catalog lists over 400 extruded aluminum shapes available without die charge.

149 **Extrusions**—BABCOCK & WILCOX CO.—6-page technical bulletin lists engineering data on the extrusion process, includes table of extrudable materials.

150 **Investment Castings**—ENGINEERED PRECISION CASTING CO.—8-page technical booklet describes the investment casting process in detail.

151 **Extrusions**—FLYNN ALUMINUM—Bulletin describes aircraft application of an aluminum extrusion.

152 **Casting Inspection**—LEBANON STEEL FOUNDRY—Bulletin discusses processes and equipment for the magnetic particle inspection of steel investment castings.

MATERIALS & EQUIPMENT

158 **Die Casting Machines**—CLEVELAND AUTOMATIC MACHINE CO.—12-page bulletin describes a complete line of high pressure, hydraulic die casting machines from 100 to 2000 ton capacities.

159 **Coating Tester**—TWIN CITY TESTING CORP.—Brochure describes non-destructive methods for measuring the thicknesses of organic and nonmagnetic metal coatings.

160 **Die Lubricant**—ACHESON COLLOIDS CO.—External house organ contains a list of available free literature on die casting die and other lubricants.

161 **Spring Steel**—UDDEHOLM CO. OF AMERICA—Brochure describes a line of spring steel available from warehouse stock.

162 **Motor Generators**—AJAX MAGNETHERMIC CORP.—Information on a complete line of vertical motor generators.

163 **Corrosion Computer**—H. M. HARPER CO.—Slide-rule type reference table tells how each of eight types of metal withstands the corrosive effects of 141 chemical agents.

164 **Metallurgical Research**—FOOTE MINERAL CO.—Brochure describes their new facilities for metallurgical research.

165 **Nylon Bearings**—BUNTING BRASS AND BRONZE CO.—Catalog lists rods, tubes, bars, and plate nylon for wear-resistant, non-seizing bearing material.

167 **Die Lubricants**—JOSEPH DIXON CRUCIBLE CO.—4-page technical bulletin on colloidal natural graphite lubricants describes a die lubricant for casting and extruding.

172 **Induction Heating**—LEPEL HIGH FREQUENCY LABORATORIES, INC.—36-page technical manual explains the induction heating process, shows its applications, and lists equipment.

173 **Beryllium Alloys**—BRUSH BERYLLIUM CO.—10-page technical booklet lists engineering data and applications for beryllium, phosper bronze, nickel silver, brass and stainless steel alloys.

174 **Iron Powder**—ALAN WOOD STEEL CO.—8-page technical bulletin on iron powder lists process and design data.

175 **Refractories**—HARBISON-WALKER REFRACTORIES CO. —16-page booklet tells how refractories are made and how they serve industry.

180 **Graphite Lubricants**—JOSEPH DIXON CRUCIBLE CO. —Technical bulletin describes a graphite lubricant used as a cutting oil additive and casting and extruding die lubricant.

181 **Metal Pump**—METAL PUMPING SERVICES INC.—Brochure describes an alloy iron pump for molten metal, includes specifications and dimensioned drawing.

FINISHING

186 **Color Decoration**—THE ACROMARK CO.—Data sheet describes a unit for color decoration and printing on metal parts without masking, spraying, or hand filling and wiping.

187 **Magnesium Finishes**—DOW METAL PRODUCTS CO. —Bulletin describes paint primers, chemical treatments, paint, and plated finishes for use on magnesium electronic components.

188 **Lock Nuts**—PALNUT CO.—24-page catalog describes a complete line of spring tempered steel lock nuts including design details and specifications.

189 **Magnesium Finishing**—BROOKS & PERKINS, INC.—14-page booklet tells what kind of magnesium finishing systems to use for specific results, includes selection guide insert which can be reproduced on a blueprint machine.

190 **Vibratory Finishing**—SYNTRON CO.—Bulletin describes vibratory barrel finishing.

191 **Barrel Finishing**—MINNESOTA MINING & MFG. CO. —14-page technical manual tells how to get the most from barrel finishing.

192 **Tumbler**—DELTA MFG. CO.—Data sheet describes a tumbler costing $85 complete which also saves 70% on labor costs.

193 **Mask Washer**—CONFORMING MATRIX CORP.—Brochure describes a small spray mask washing machine for use at the work station.

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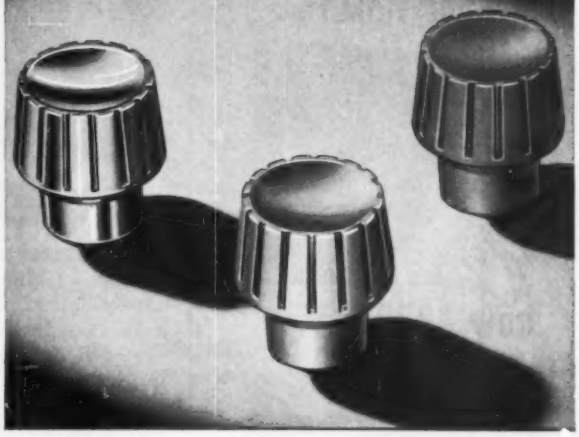

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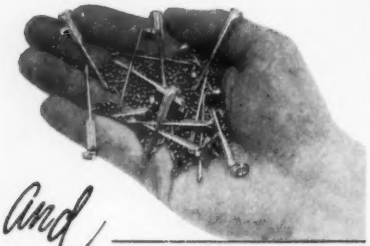

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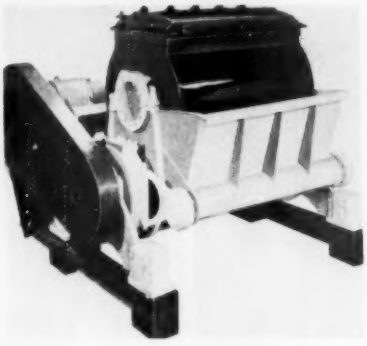

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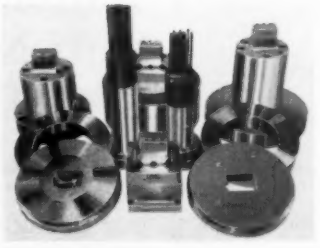

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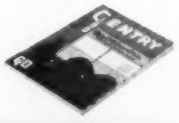

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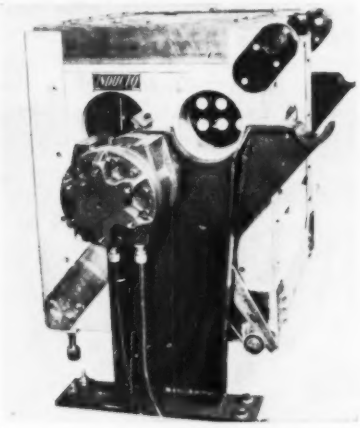

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UNFAILING PERFORMANCE

Originators of sintered helical gears. Master craftsmen in producing highest quality, dimensionally perfect parts from powdered metal in Brass, Bronze, Copper, Nickle Silver, Steel, Iron, Iron Alloys — Copper Infiltration.

WRITE FOR CATALOG AND TECHNICAL BULLETIN.

POWDERED METAL DIVISION
MERRIMAN BROS., INC.
ORIGINATORS OF SINTERED HELICAL GEARS
185 Amory Street Boston 30, Mass.
REPRESENTATIVES IN PRINCIPAL CITIES
100 Beach Road
Massapequa (L.I.), New York
793 Laurelton Rd.
Rochester 9, N.Y.

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Lepel

HIGH FREQUENCY INDUCTION HEATING UNITS

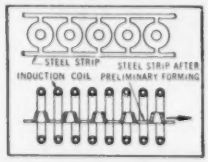
Lepel induction heating equipment represents the most advanced thought in the field of electronics... the most practical and efficient source of heat developed for numerous industrial applications. You are invited to send samples of work with specifications. Our engineers will process and return the completed job with full data and recommendations without cost or obligations.

TYPICAL INDUCTION HEATING APPLICATIONS

PLASTIC COATING OF TOOL HANDLES

A production line operation for coating handles of tools at Whitney Metal Tool Co., Rockford, Ill. uses induction heating with excellent results. The handles only are heated by induction to the desired temperature then dipped into a vinyl chloride base coating material for a short period depending upon the thickness of coating desired. The plastic coating formed on the handles is then cured by immersion in a carbo-wax bath.

FORMING OF METAL STRIP FACILITATED BY PROGRESSIVE ANNEALING



Metal forming operations which require intermediate anneals to restore ductility can be facilitated by induction annealing the strip progressively. Diagram illustrates this procedure for partially formed thin austenitic stainless steel strip. The induction annealing operation is scheduled in the production line between two press operations. Metal strip and wire of other materials are also induction annealed in this manner.

WRITE FOR NEW LEPEL CATALOG
Electronic Tube Generators from 1 Kw to 100 Kw.
Spark Gap Converters from 2 Kw to 30 Kw.

Lepel HIGH FREQUENCY LABORATORIES, INC.
55th ST. & 37th AVE., WOODSIDE 77, N. Y.

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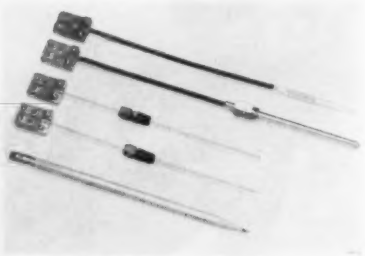
NEW PRODUCTS *(cont.)*

THERMOCOUPLES



HARCO LABORATORIES, INC.—These miniaturized, low priced thermocouple assemblies cover virtually the entire range of thermocouple temperature sensing applications. Their specific performance is guaranteed to equal or surpass that of the most expensive models.

Response is thousands of times faster than many thermocouples now in use.

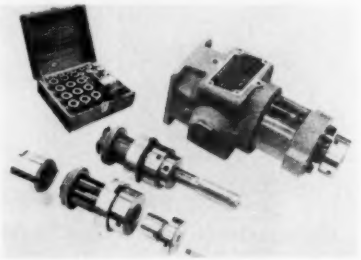
Circle No. 245 on Reader Service Card

ALLOY TREATMENT

FOUNDRY SERVICES, INC.—Nucleant, a new metallurgical compound, reduces the grain size and increases the structural strength in aluminum and aluminum alloy castings. It will also enhance the feeding properties of the melt, increase resistance to hot tearing in the casting, and reduce homogenizing.

Circle No. 246 on Reader Service Card

TAPPING HEAD



BURG TOOL MFG. CO., INC.—The Burgmaster Leadmatic lead screw tapping head improves the finish and accuracy of tapped threads and eliminates scrap due to pulled or loose threads. The drive runs in ball bearings, and the engagement of forward and reverse motions is through multiple tooth, positive jaw clutches.

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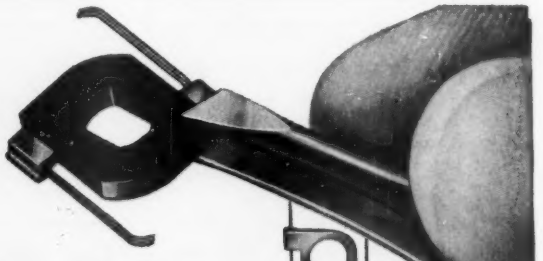
another wonderful GRC idea for designers



GRC's UNIQUE AUTOMATIC METHODS INSERT THREADED PIECES, WIRES, even CONTINUOUS ELEMENTS, RIGHT IN THE MOLDING OR CASTING CYCLE

Fast . . . economical, GRC's exclusive automatic machines insert elements in zinc alloy die castings . . . in thermoplastic moldings, assure uniformity, eliminate assembly . . . make possible entirely new designs . . . cut labor and costs.

No size is too small! Maximums: Zinc Alloy 1½", ½ oz.—Plastic 1¼", .03 oz.

Write for samples, prices and bulletins. Send prints for quotation.

A DOUBLE INSERT Part, automatically produced

For this IBM Brush Assembly, the core is die cast automatically and continuously onto 6 strands of music wire, 3 on each side.

In the second cycle the nylon insulating jacket is molded automatically and continuously . . . right onto the die cast core and wire inserts.

GRIES

GRIES REPRODUCER CORP.

World's Foremost Producer of Small Die Castings

157 Beechwood Ave., New Rochelle, N. Y. • Phone: NEw Rochelle 3-8600

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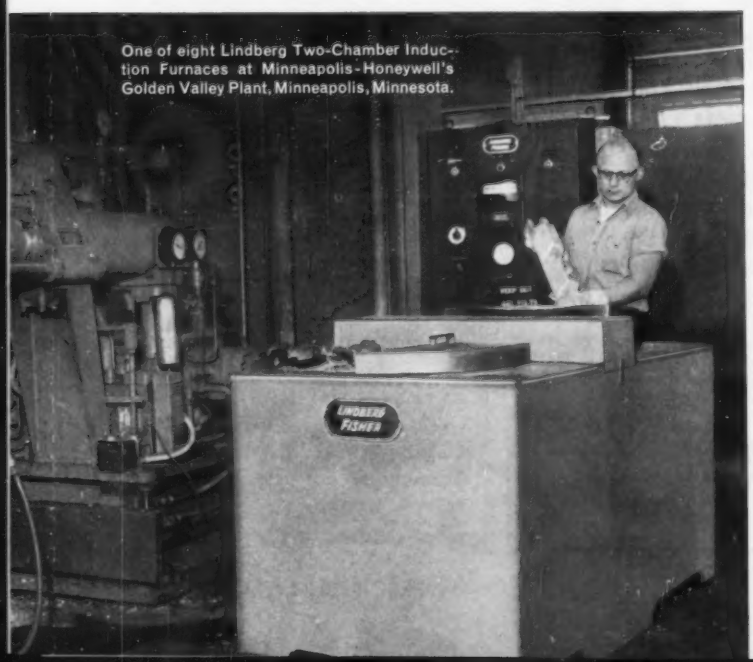
ART GEORGE has a good word to say for Lindberg Melting Furnace performance

QUOTE

Mr. Art George, Senior Production Engineer, Golden Valley Plant, Minneapolis-Honeywell Regulator Company, Minneapolis, Minn.

"Our installation of eight* Lindberg-Fisher Two-Chamber Induction Melting and Holding Furnaces has given remarkable service for more than four years. In this period, with the help of a well executed Honeywell maintenance program, the installation has been unusually trouble-free. Only one of the eight furnaces has required relining over this long period. Handling more than 1,000,000 pounds of aluminum and zinc annually, the installation has unfailingly provided the consistently high quality of metal our precision instruments require."

**Altogether, 44 Lindberg Furnaces are in operation in various Honeywell plants.*



One of eight Lindberg Two-Chamber Induction Furnaces at Minneapolis-Honeywell's Golden Valley Plant, Minneapolis, Minnesota.

These eight Lindberg-Fisher Induction Furnaces melt and hold aluminum and zinc for die casting gas valve housings and other component parts. They are located at the die casting machines where ingot and scrap can be melted and held at the desired casting temperature in one convenient unit. Magnetic fluxing and stirring insures uniform temperatures and consistently clean metal.

In any production process where aluminum needs heat there is Lindberg equipment to apply it most economically and efficiently. Furnaces for melting and holding, casting stations, re-melting or heat treating are available in all capacities, electric or fuel fired. Get in touch with your Lindberg Field Engineer (see your classified phone book) or write us direct. Lindberg-Fisher Division, Lindberg Engineering Company, 2463 West Hubbard St., Chicago 12, Illinois.

Los Angeles plant: 11937 S. Regentview Avenue, Downey, California. In Canada: Birlefco-Lindberg Ltd., 15 Pelham Ave., Toronto 9, Ont. Also, Lindberg plants in Argentina, Australia, England, France, Italy, Japan, South Africa, Spain, Switzerland and West Germany.

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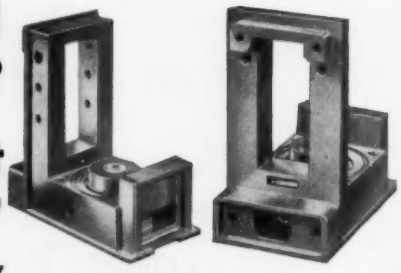
LINDBERG
heat for industry

Circle No. 43 on Reader Service Card

Dimensional Accuracy? YES... but Other 'Specs' are Equally Exacting!



Two views of zinc die-cast body for Air Controlled Timing Valve.

In addition to exacting dimensional tolerances, users of die castings often require other equally precise specifications to be met. For example, in the zinc die-cast body for the Air Controlled Timing Valve pictured, the following requirements were specified to insure successful assembly and functioning: absolute *solidity* and *high density* of the zinc alloy to prevent air leakage — along with a cast-in diaphragm surface absolutely smooth and free from imperfections; bottom of rectangular hole free from burrs; all plane surfaces flat and either parallel or square to one another.

Milwaukee operates under the Certified Zinc Plan of the American Die Casting Institute.

Milwaukee has been meeting *exacting requirements* like these for more than a half century!

MILWAUKEE DIE CASTING COMPANY

4146 N. HOLTON STREET • MILWAUKEE 12, WISCONSIN

Established 1909

Colloidal Graphite dispersions

can help you

3 WAYS:

1. Production — For established production processes we will prepare dispersions to meet your specifications.
2. Development — We will work directly with your engineers on development projects requiring specialized dispersions.
3. Research — Our research staff is always available for consultation on new products, new processes and new applications.

Here are a few uses of

Colloidal Graphite Dispersions:

- DIE LUBRICANT
- DRY FILM LUBRICANT
- IMPREGNATING COMPOUND
- HIGH TEMPERATURE LUBRICANT
- PARTING COMPOUND
- FORGING COMPOUND

A qualified staff is available for prompt recommendations and quotations to meet your specifications or preliminary inquiries to our sales department.

GRAPHITE PRODUCTS CORP.

BROOKFIELD, OHIO

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INDUSTRY NEWS*continued*

MOLLICK NAMED ENGINEERING MANAGER

MOLLICK

Baldwin-Lima-Hamilton Corporation has announced the appointment of Leon Mollick as Manager of Engineering, Industrial Equipment Division. Mollick has been associated with the division as Chief Stress Analyst for 10 years, directing research, development and stress analysis in the U.S.A.F. Heavy Press Program and other special engineering problems.

VANADIUM-ALLOYS FORMS NEW DEPARTMENT

Vanadium-Alloys Steel Company today announced the organization of a new Cast-to-Shape Products Department in order to meet the requirements for tool and special steel castings.

The new department, located in the main plant at Latrobe, Pa., has been manufacturing sand, shell and Shaw Process castings for the past several months.

NEW LATROBE WAREHOUSE

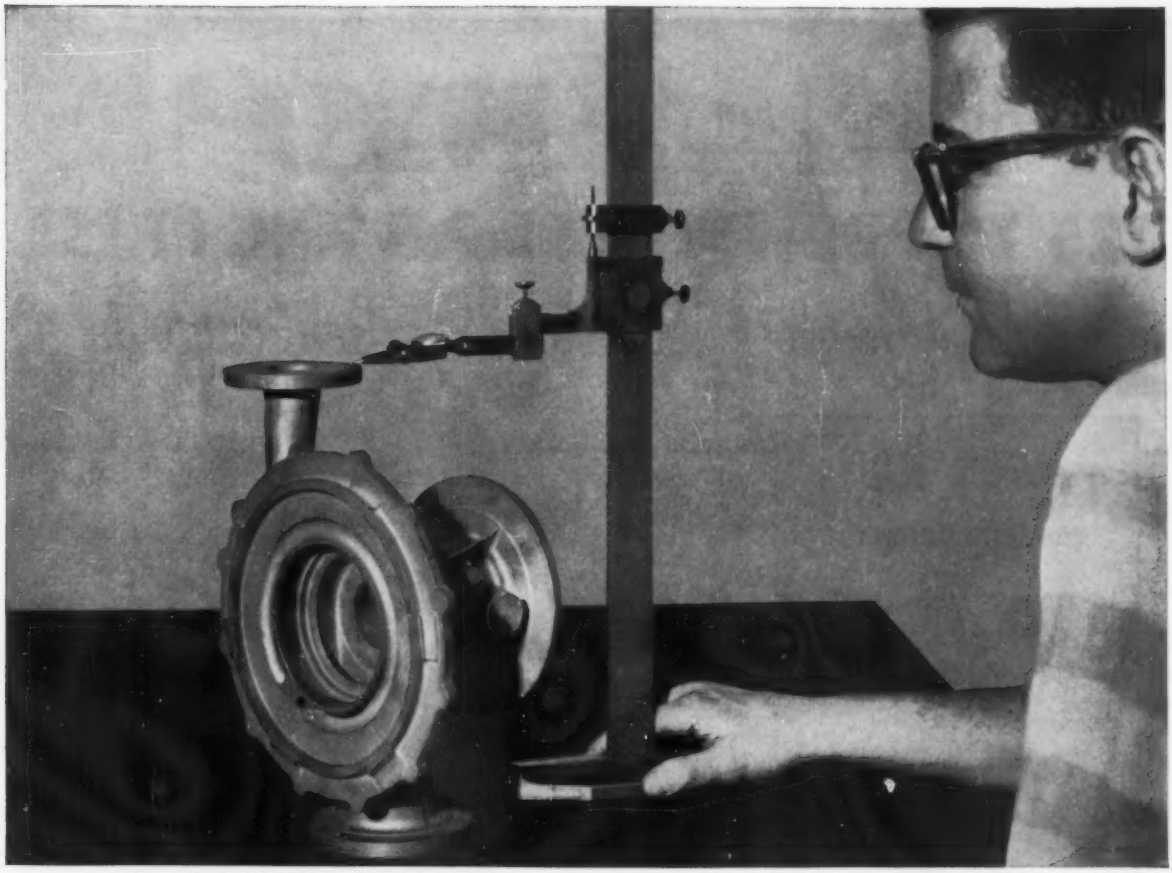
Latrobe Steel Company's latest Steel Service Center, for the warehousing and distribution of tool, die and specialty steels has been opened at Grand Rapids, Michigan.

The Grand Rapids facility will give customers in the western and northern sections of the state immediate delivery service on their tool and die steel requirements.

INVESTMENT CASTER MOVES

The Connecticut Investment Casting Corp. has moved from Stonington to a new plant in Pawcatuck, Conn.

more industry news on page 60



Arwood adds a new dimension to investment casting—

SIZE

Until now, an investment casting has been something you could hold easily in one hand. Today, thanks to a series of technological breakthroughs, Arwood can offer you investment castings so large and heavy that you need two hands even to budge them from the floor!

The new weight limit approaches 100 pounds.

What does this mean to you? It opens a whole new realm of possibilities in the design of component parts. For the first time, a designer can avail himself of investment casting's special advantages over a complete size range that runs from a fraction of an ounce up to weights heretofore available only in sand castings. Advantages like investment casting's ability to reproduce complex, hard-to-machine shapes in any castable metal or alloy . . . its low initial tooling expense . . . the dimensional accuracy and smooth surface finish characteristic of investment cast parts.

So . . . for quality investment castings in any ferrous or non-ferrous alloy . . . and in any size and weight . . . check with Arwood. We can free your hands to design for function and end use, because we can give you the *shape* you need in the *metal* you need in the quantity you need, no matter how *large* the part on your board. All five Arwood plants stand ready to serve you.

Write for your free copy of our 44-page "Practical Guide to Investment Casting."

Machine the simple . . . cast the complex

A complete service from design through tooling, production and finish machining. Seventy-one engineering representatives from coast to coast.

arwood

ARWOOD CORPORATION • 323 West 44th Street, New York 36, New York

PLANTS IN BROOKLYN, N. Y.; TILTON, N. H.; GROTON, CONN.; LOS ANGELES AND LA VERNE, CALIF.

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All new from KUX

125 TON POWDER COMPACTING PRESS

6" die fill—full 125 tons ejection capacity

MODEL 1100

COMPLETELY AUTOMATIC

125 TONS COMPACTING PRESSURE APPLIED BY UPPER AND LOWER PUNCHES

125 TONS EJECTION PRESSURE

MASSIVE, ALL STEEL MAIN FRAME

RUGGED MECHANICAL TOGGLE OPERATION

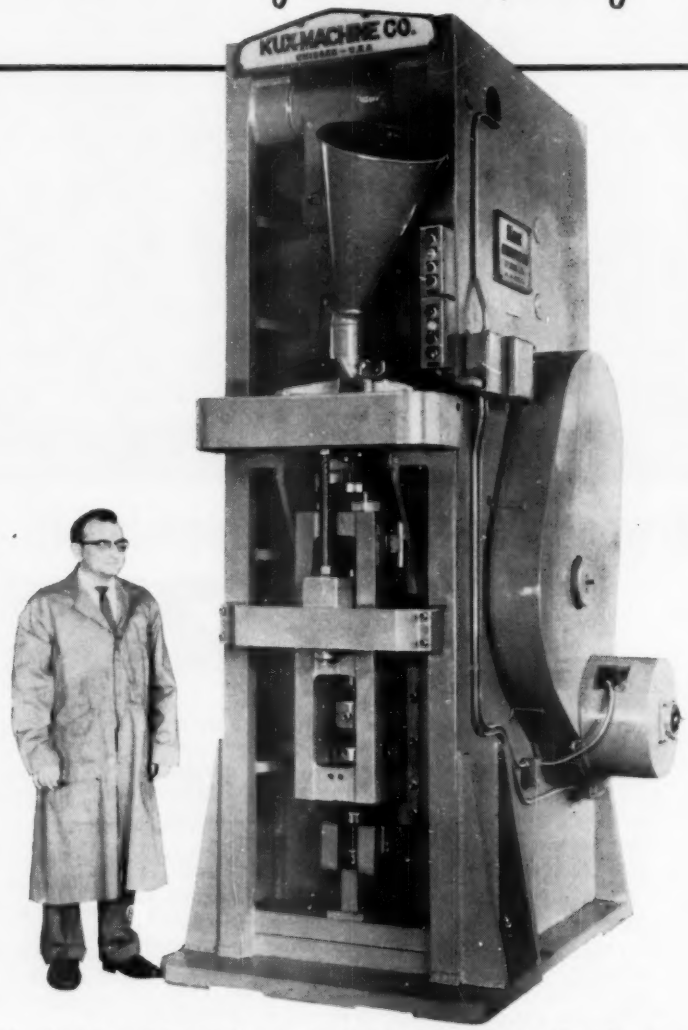
PRECISION PUNCH AND DIE ALIGNMENT

HEAVY DUTY STATIONARY CORE BRACKET

FLOATING CORE ROD WITH TIMING CONTROL

PUSH BUTTON—SINGLE CYCLE OR CONTINUOUS OPERATION CONTROL

SIMPLICITY OF ADJUSTMENTS—NO NEED FOR CAM CHANGES



Massive, all steel, heavy duty mechanical press for powdered metals, ceramics, plastic preforms, tungsten carbides and other powdered or granular materials. An unusual feature of this machine is its capacity to eject a compact with full 125 tons pressure. Both upper and lower punches apply pressure to the part being formed with capacity of up to 6" die fill and the machine is capable of making parts up to 6" diameter or length. Dwell under compression allows compact to set while under pressure. Floating core rod mechanism with up to 4" stroke and moving die table can also be incorporated.

KUX MACHINE CO. • 6725 NORTH RIDGE • CHICAGO 26, ILLINOIS

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3	21	39	57	75	93	111	129	147	165	183	201	219	237	255	273	291	309	327	345	363	381	399
4	22	40	58	76	94	112	130	148	166	184	202	220	238	256	274	292	310	328	346	364	382	400
5	23	41	59	77	95	113	131	149	167	185	203	221	239	257	275	293	311	329	347	365	383	401
6	24	42	60	78	96	114	132	150	168	186	204	222	240	258	276	294	312	330	348	366	384	402
7	25	43	61	79	97	115	133	151	169	187	205	223	241	259	277	295	313	331	349	367	385	403
8	26	44	62	80	98	116	134	152	170	188	206	224	242	260	278	296	314	332	350	368	386	404
9	27	45	63	81	99	117	135	153	171	189	207	225	243	261	279	297	315	333	351	369	387	405
10	28	46	64	82	100	118	136	154	172	190	208	226	244	262	280	298	316	334	352	370	388	406
11	29	47	65	83	101	119	137	155	173	191	209	227	245	263	281	299	317	335	353	371	389	407
12	30	48	66	84	102	120	138	156	174	192	210	228	246	264	282	300	318	336	354	372	390	408
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14	32	50	68	86	104	122	140	158	176	194	212	230	248	266	284	302	320	338	356	374	392	410
15	33	51	69	87	105	123	141	159	177	195	213	231	249	267	285	303	321	339	357	375	393	411
16	34	52	70	88	106	124	142	160	178	196	214	232	250	268	286	304	322	340	358	376	394	412
17	35	53	71	89	107	125	143	161	179	197	215	233	251	269	287	305	323	341	359	377	395	413
18	36	54	72	90	108	126	144	162	180	198	216	234	252	270	288	306	324	342	360	378	396	414

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- ☐ Shell Mold Castings
- ☐ None of these

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DATA OFFERED IN THIS MONTH'S ADS

Qualified readers may obtain any of these free reference materials by circling the numbers on the Reader Service Cards facing page 58

4. **Iron Powder**—Alan Wood Steel Co.—Technical and Application Information—on custom-mixed blends, and high-purity iron powders.

5. **Tool Steel**—Allegheny Ludlum Steel Corp.—Booklet—describes the Steelector method for selecting the tool steel that meets your particular requirements.

7. **Die Castings**—American Smelting & Ref. Co.—Technical Information—on electrolytically refined high-grade zinc and other alloys for die casting.

10. **Investment Casting**—Arwood Corp.—44-page Booklet—"Practical Guide to Investment Casting."

11. **Plaster Mold Castings**—Atlantic Casting & Engineering Corp.—Technical Information—on precision castings "large as a small suitcase."

13. **Compacting Press**—Baldwin-Lima-Hamilton Corp.—Technical Data—on compacting press for high-speed production and economical operation.

19. **Die Casting Dies**—Crucible Steel Co. of America—Technical Data—on CSM 2 tool steel which eliminates the heat treatment of most zinc die casting dies because of its uniform hardness.

20. **Production Ovens**—Despatch Oven Co.—Bulletin—No. 203-5 DE on Despatch RS-3 Model production ovens.

21. **Die Casting Dies**—Detroit Mold Engineering Corp.—170-page Catalog—describes standardized die components which reduce design time and cut die construction costs.

22. **Tool & Die**—Gentry Carbide Tool & Die Co.—6-page Brochure—shows its equipment for making carbide tools and dies.

23. **Industrial Colloidal Lubricants**—Grafo Colloids Corp.—Booklet—"The Biggest Ounce of Protection."

25. **Zinc Die Castings**—Gries Reproducer Corp.—Bulletins—describe tiny zinc parts made by automatic die casting methods.

27. **Zinc Alloys**—Henning Bros. & Smith—Technical Booklet—tells how to select zinc base die casting alloys.

28. **Investment Casting**—Hitchiner Mfg. Co.—13-page Booklet—explains the ceramic shell investment casting process and shows Hitchiner's facilities.

32. **Die Casting Machines**—H-P-M, Koehring Div.—Catalog—CM-100 describes all Cast-Master die casting machines.

35. **Investment Castings**—Investment Casting Co.—Catalogue—on its cost cutting methods.

39. **Extrusion Tool Steels**—Latrobe Steel Co.—Technical Data—on a complete line of extrusion tool steels.

40. **Induction Heating**—Lepel High Frequency Laboratories, Inc.—Catalog—describes high-frequency induction heating equipment.

42. **Sinterings**—Merriman Bros., Inc.—Technical Bulletin and Catalog—on highest quality, dimensionally accurate sinterings.

44. **Extrusions**—Midwest Aluminum Corp.—Brochure—describes extrusion services from design to finished product.

45. **Sander**—Merit Products, Inc.—Catalog—on Sand-O-Flex sander for deburring and finishing operations.

51. **Powdered Metal**—New Jersey Zinc Co.—Booklet—describes how to design for pressed brass and nickel-silver powdered metal parts.

52. **Pumping Systems**—New York Air Brake Co.—Bulletin—No. 4000.1 describes Kinney Packaged Pumping Systems.

53. **Pinions and Racks**—Peerless Gear & Machine Co.—Catalog—No. 167-A describes pinions and racks made for users of die casting molds and permanent molds.

54. **Mold Lubrication**—Pierce-Waller, Inc.—Data Sheet—on the Air-Lube system for cleaning and lubricating mold and die surfaces.

55. **Sinterings**—Reese Metal Products Corp.—16-page booklet—tells how to cut precision parts costs with the Remet powdered metal process.

57. **High-Purity Nickel**—Sherritt Gordon Mines Ltd.—Brochure—includes prices and delivery information on high-purity nickel.

59. **Ladles**—Spincraft, Inc.—Data and Prices—on stainless steel ladles of non-spill design which are 75% lighter than cast iron models.

64. **Temperature Control**—West Instrument Corp.—Bulletin—COM on tubeless controls designed for equipment which require temperature controls.

65. **Burnishing Media**—The Abbott Ball Co.—Bulletin—tells how its burnishing media produces a gleaming, long lasting, polished surface.

66. **Copper Plating**—Allied Research Products, Inc.—Technical Data Files—discuss a complete line of supplies for copper plating.

67. **Nickel Plating**—American Smelting & Refining Co.—Information—on how the Levelmax process produces a bright nickel coating on unbuffed castings.

68. **Chemical Finishing**—Heatbath Corp.—Technical Data—on chemicals for polishing, deburring, and protecting die castings.

INDUSTRY NEWS *(continued)*

DIE CASTING EXPOSITION AND CONGRESS

The First National Die Casting Exposition and Congress, sponsored by the Society of Die Casting Engineers, was held in the Detroit Artillery Armory from November 8 to 11. Observers termed the event an unqualified success.

Exhibitors included both contract and captive die casting shops, alloy producers and manufacturers of die casting machines and accessories, finishing systems, dies and die accessories.

At the Congress, held in conjunction with the exposition, technical papers were presented by speakers from Italy, England, as well as the United States.

Visitors seemed particularly interested in the die cast aluminum engine block at the PRECISION METAL MOLDING booth. This block was die cast by Doehler-Jarvis for American Motors.

slash costs of hard-to-make parts

Have a list of alloy parts you're now using? And their cost? Willing to invest a stamp to cut these costs?

Using the "lost wax" process, we'll cast, in our modern plant, about any shape part you need—at a surprisingly low per unit cost.

Just send a sketch of each part to Westinghouse Electric Corporation, Metals Plant, Blairsville, Pa. If it's castable, we'll snap back with details on prototype or production quantities. Shell-mold and vacuum casting also available. J-05012

Westinghouse investment casting produced this circuit breaker trigger as a single piece. Elimination of machining and assembly time reduced production costs by 60%.

You can be sure . . . if it's

Westinghouse

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CLEARING DIVISION APPOINTMENTS

CUNNINGHAM

BAUMRUCKER

The following appointments were announced by John R. Bartizal, President of Clearing Division of the U. S. Industries, Inc.

E. P. Cunningham appointed Senior Vice President-Director International Operations. Mr. Cunningham had previously been General Sales Manager and Vice President of Domestic Sales. He has been associated with the Clearing division since 1934.

E. J. Baumrucker appointed Vice President Domestic Sales. Mr. Baumrucker had previously been Manager of the Detroit area and recently General Sales Manager.

SALES DIRECTOR NAMED

Ernest J. Csaszar has been promoted to director of sales for the Newark Die Company, Inc., and its subsidiary, Newark Die Hobbing and Casting Company.

For the last four years, Csaszar has been manager of sales under the chief engineer and sales director. In his new post, he will be in complete charge of all sales and marketing programs for the two companies.

STEVENS MOVES

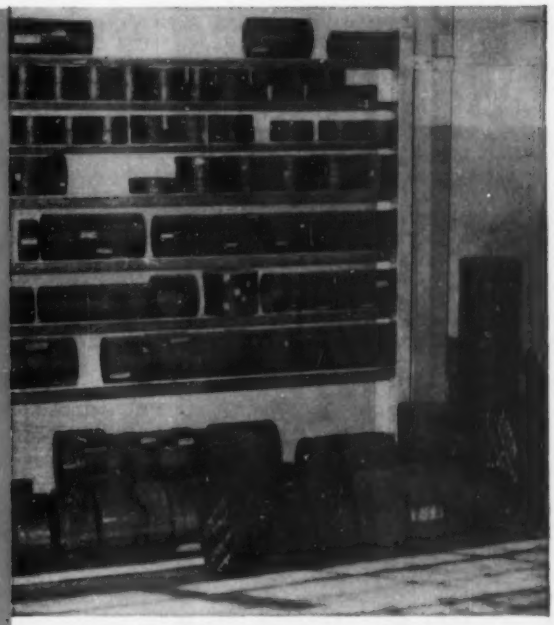
As part of an expansion program in the New England area, Frederic B. Stevens, Inc. has moved its plant from New Haven to Wallingford, Connecticut.

The new Stevens installation enables the Detroit concern to expand its facilities for the manufacture of buffing compositions and the warehousing of supplies and equipment for the foundry and metal finishing trades.

A laboratory for the testing of metal finishing materials and equipment is also being established in the new building.

more industry news on page 62

Made to give service!



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LATROBE'S EXTRUSION TOOL STEELS

Whether for regular or special application, getting into extrusion production in a minimum of time depends, in great part, on quality tool steel and its availability when you need it.

Latrobe's Extrusion Tool Steel forgings have built-in quality! They are dependable . . . have guaranteed internal soundness . . . and are easy to saw, file and machine.

And for availability—your nearby Latrobe Steel Service Center is stocked in a wide range of grades and sizes to meet your delivery requirements.

Stocked for prompt delivery!

LPD • Type H-12
VDC • Type H-13
VISCOUNT 20 • Free-machining Type H-13
VISCOUNT 44 • Prehardened, machinable Type H-13

MEMBER OF AEC ALUMINUM EXTRUDERS COUNCIL

Call your Latrobe Steel Service Center today . . . or write for literature on individual grades.

Manufactured by skilled American labor

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BRANCH OFFICES AND STEEL SERVICE CENTERS: BOSTON • BUFFALO • CHICAGO CLEVELAND • DAYTON • DETROIT • GRAND RAPIDS • HARTFORD • LOS ANGELES • MIAMI MILWAUKEE • NEW YORK • PHILADELPHIA • PITTSBURGH • SAN LEANDRO • TOLEDO YOUNGSTOWN

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*DURACAST-40

NEW workhorses for you. Write now for literature on new Duracast-30 and Duracast-40. Learn what they can do for you.

For Non-Ferrous Metals
K-90
DURACAST
DURACAST-20

Backups for Ferrous Castings
FERROMOLD-VACUUM TYPE
VIBRAPOUR-VIBRATING TYPE

KERR MANUFACTURING CO.
6081 Twelfth St. • Detroit 8, Michigan

DEALERS
CASTING SUPPLY HOUSE • New York, New York
DICK ELLS CO. • Los Angeles, California

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INDUSTRY NEWS *continued*

NEW JERSEY ZINC PROMOTIONS

ROSENQUEST

PRINCE

The New Jersey Zinc Company announced the promotions of R. William Rosenquest to Manager Metal Sales, Eastern Division and Charles H. Prince to Manager Technical Service, Metal Division.

Rosenquest has been a sales representative for the Company's metals and alloys for 12 years. He is a graduate of Lehigh University.

Prince has been in technical service work for the past 6 years, serving the Company's customers in the metalworking fields. He holds a degree in metallurgy from Massachusetts Institute of Technology and an M.B.A. from Columbia University.

ACHESON APPOINTS LANG

A new sales representative, Henry J. Lang, has been appointed to the Western Pennsylvania-West Virginia area for Acheson Colloids Company.

For the past year, Lang has been the Acheson sales representative for the state of Michigan. Prior to this he was with Acheson's Philadelphia office which serves the Atlantic seaboard.

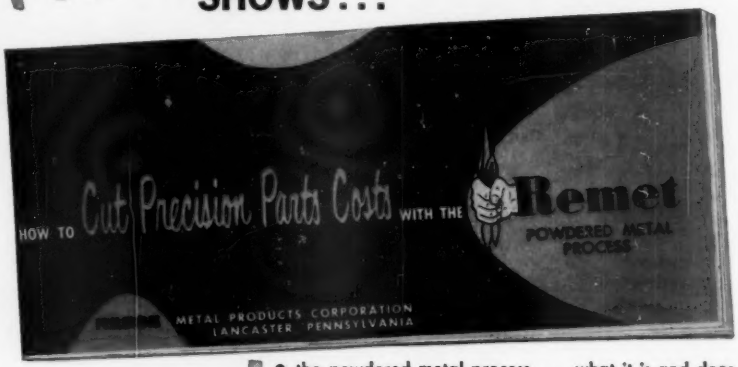
GLIDDEN NAMES McELROY

Appointment of George H. McElroy to the newly-created position of sales manager of the Metals Department of The Glidden Company's Chemicals Division has been announced.

It was also announced that John O. Jones has joined Glidden as Cleveland district sales manager for the Pigments and Color Department of the division, replacing McElroy. Both men will headquarter in Cleveland but will report to Ralph B. Quelos, general sales manager for the two departments.

more industry news on page 67

FREE POWDERED METAL PARTS BOOKLET SHOWS . . .



colorful, newly revised 16-page booklet illustrates and describes:

- the powdered metal process . . . what it is and does
- gives limitations and advantages of the powdered metal process
- shows design DO's and DON'T's for powdered metal parts
- provides physical characteristics chart of standard Remet materials
- plus specific application stories

Send for your copy of this helpful booklet today!

Remet
REESE METAL PRODUCTS CORPORATION
537 Howard Ave., Lancaster 10, Penna.

Gears • Pinions • Cams • Ratchets "Oilless" Bearings • Bushings • Machine and Structural Parts in COPPER • BRASS • IRON • ALLOY STEEL • NICKEL SILVER • COPPER INFILTRATED IRON

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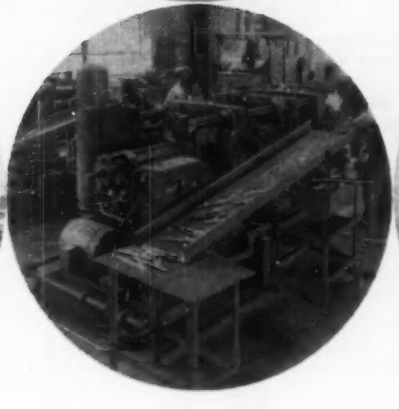
DIE CASTING

. . . a new source



A spacious new building . . . an experienced team of specialists . . . production lines of the most modern equipment . . . all have been combined in this progressive new company to serve your need for precision products die cast of non-ferrous alloys. Send your inquiries, blue prints, or preliminary sketches for immediate and professional attention.

SOUTHERN DIE CASTING & ENGINEERING

206 Albertson Road
High Point, North Carolina

Sales territories are available for representation. Write to John A. Weber, Vice President.

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DIE CASTING DIE ALIGNMENT CHART

For estimating the gate length (width) and thickness for die casting dies.

EXAMPLE 1

Given: A die for a magnesium casting which weighs 1.15 lbs. including overflows. With a gate thickness of 0.050" determine the gate width (length).

Draw a line through 1.15 lbs. of magnesium and 0.050" gate thickness. The line intersects the gate width at 5.53".

EXAMPLE 2

Given: A die for an aluminum casting which weighs 3.0 lbs. including overflows. Maximum gate width (length) is 7.0", required the gate thickness.

Draw a line through 3.0 lbs. of aluminum and 7.0" gate length. This line intersects the gate thickness of 0.060".

EXAMPLE 3

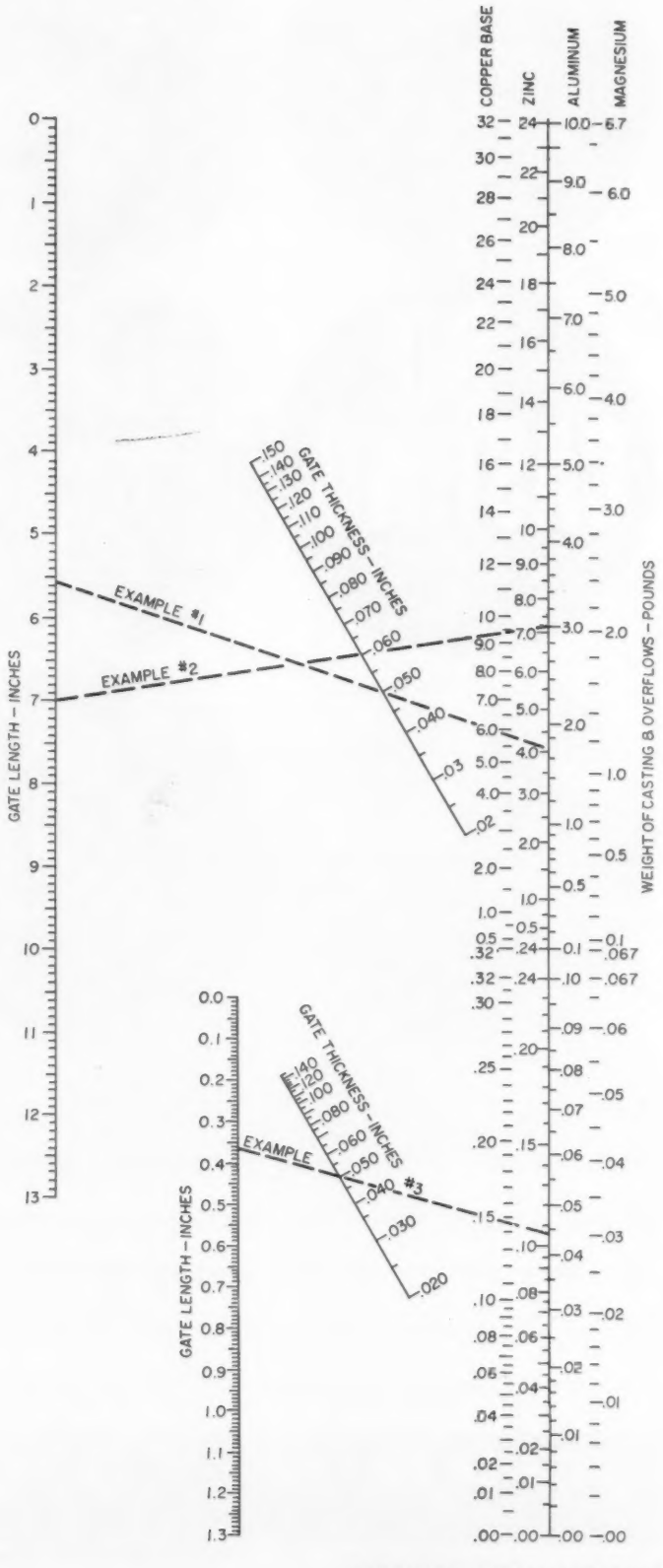
Given: A die for a manganese bronze casting which weighs 0.14 lbs. including overflows. Gate thickness is 0.050", required the gate width (length).

Draw a line through 0.14 lb. copper base casting and 0.050 gate thickness. The line intersects the gate width at 0.362".

Note: The equation for this nomograph is:

$$L = 0.0334\, V^{\cdot 745}/T$$

where L = length (width) of the gate.
V = volume of the casting.
T = thickness of the gate.



This nomograph was prepared by the Western Die Casting Co.

Copies are available from PRECISION METAL MOLDING for 25¢ each.

These chips cost money. They represent dollars in wasted materials together with the time and labor cost of extensive and unnecessary machining. You can eliminate all of this through the use of Investment Castings.

There are many advantages gained when you use Investment Castings. Parts now made by other means or those now on your drawing board for your designs large or small, simple or complex, can be economically reproduced – in tens or thousands – in most castable alloys and to meet your specifications and design requirements.

Investment Castings will reduce tooling cost, machining time and provide the latitude for designs otherwise impossible.

Send for our Investment Casting Catalogue now. We have representatives in most industrial areas and they'll be happy to discuss your problems with you.

Let the chips fall where they may. We know we can save you money and time using Investment Castings.

INVESTMENT CASTING

INVESTMENT CASTING COMPANY

A Subsidiary of Faradyne Electronics Corp.

60A Brown Avenue • Springfield, New Jersey

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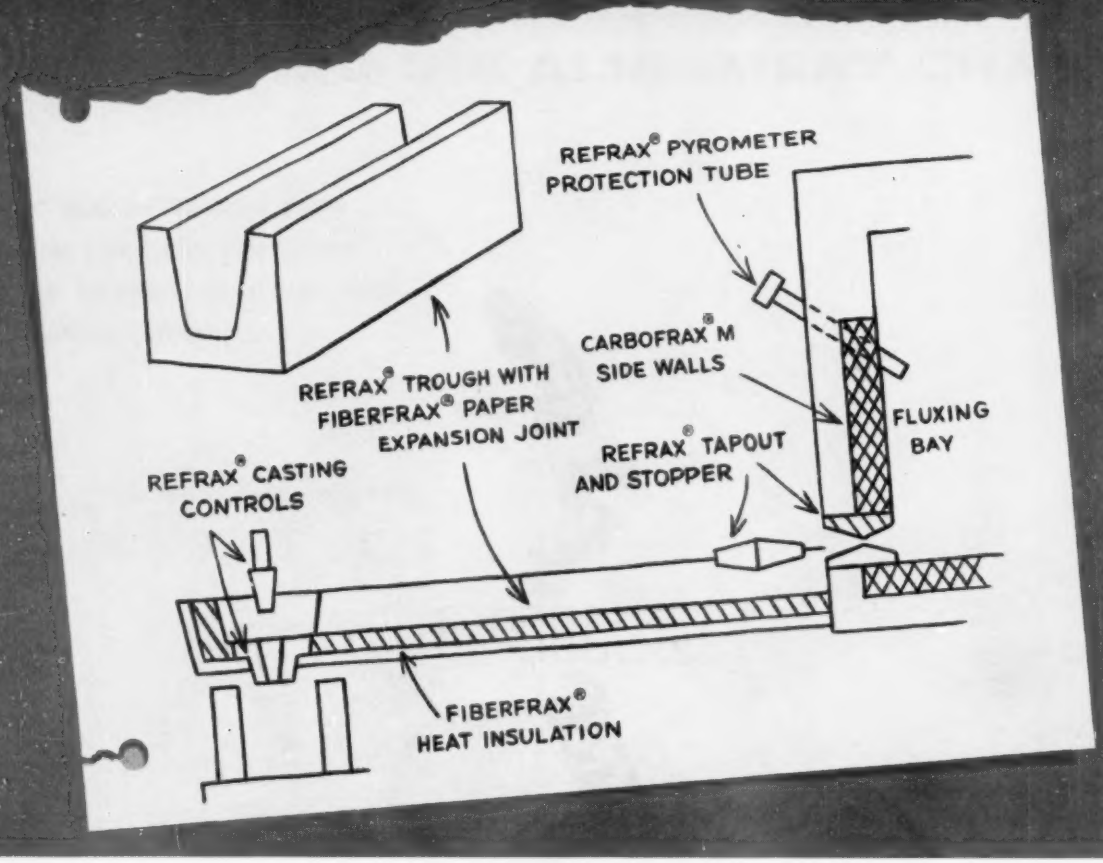

Design hints on refractories for aluminum furnaces

How to reduce casting trough and launder problems

These problems are solved by a special refractory. It is REFRAX® *silicon-nitride-bonded silicon carbide.* This material requires less maintenance, eliminates inclusions and assures easier cleaning.

In short, its unusual properties provide virtually trouble-free service in these locations. Metal penetration is avoided; no chemical reactions occur and erosion by the molten metal cannot be detected.

Where several trough lengths are required, joints should be filled with FIBERFRAX® paper. It, too, resists metal penetration and attack.

Special-purpose refractories made by Carborundum offer a choice of materials to meet widely varying needs in other critical areas of aluminum-melting furnaces.

CARBOFRAX® *ceramic-bonded silicon carbide,* for example, is made in a variety of compositions suitable for hot walls, side walls, bottoms, charging ramps and door jambs and sills. REFRAX *silicon-nitride-bonded silicon carbide* can be supplied in accurately dimensioned shapes with high strength and resistance to thermal shock. It is not wet by molten aluminum. Special uses are found in furnaces subject to intermittent operation. ALFRAX® *fused alumina bubble insulating brick* are light in weight, withstand high temperatures and have the low heat transfer qualities needed in walls and roofs above the metal line. MULLFRAX® *electric furnace mullite* offers resistance to flame erosion and spalling plus low heat conductivity. It is widely used for burner blocks.

For assistance and recommendations on how to engineer refractories to your specific furnace needs contact Dept. R-120, Refractories Division, The Carborundum Company, Perth Amboy, N. J. Phone: Hillcrest 2-3380.

For engineered refractories . . . count on

CARBORUNDUM®

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ASARCO NAMES NOCK

Walter J. Nock has been appointed Vice President in charge of the Mexican Division of American Smelting and Refining Company.

Nock was formerly General Manager of Asarco's Mexican Mining Department.

REIMERS NAMED TECHNICAL SERVICE REPRESENTATIVE

Robert S. Reimers has been appointed a technical service representative of Foundry Services, Inc., the Cleveland company announced today.

Reimers, who has a background in applied metallurgy, will represent the Foseco product line in northern Illinois and Iowa, according to company president David T. Morgenthaler.

MIKSCH ELECTED

MIKSCH

BERGQUIST

The board of directors of Newark Die Company, Inc. has elected Nathan M. Miksch president. Miksch, formerly treasurer, joined the company in 1945.

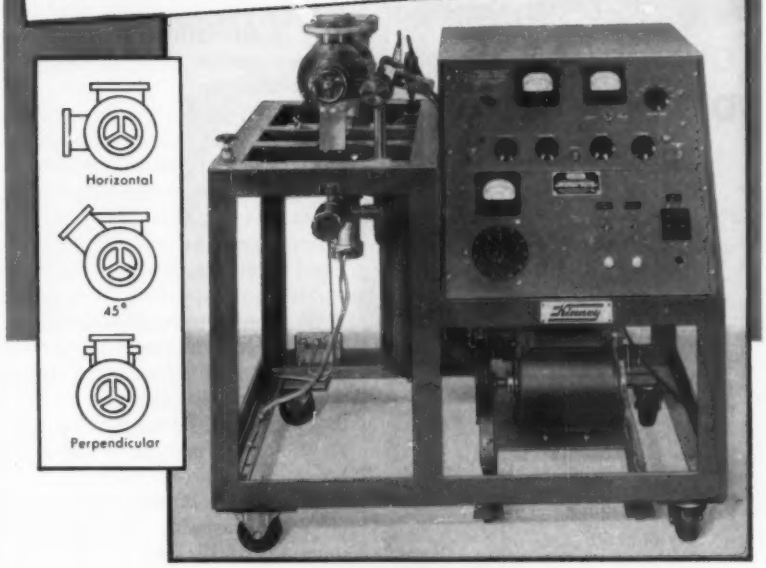
Newark Die also announced the appointment of Victor P. Bergquist as plant manager. Bergquist joined the company in 1934 and has held a number of production posts.

ALLIED RESEARCH ADDS BARREL COMPOUNDS

Allied Research Products, Inc., manufacturer of metal finishing supplies and equipment, has announced the addition of a line of barrel finishing compounds to its products.

A variety of these compounds is available for finishing practically any type of metal or plastic part. The materials from which the compounds are made include oxide chips, ceramic shapes, granite chips, limestone chips, natural stone and steel balls.

a Vacuum Workhorse for Laboratories with Many and Varied Problems...



Kinney®

PW-200 Packaged Pumping System

IT'S MOBILE... CAN BE MOVED ANYWHERE!

EASY TO CONVERT TO A VACUUM EVAPORATOR

PRESSURES TO 5×10^{-7} MM HG

STURDY, VERSATILE, DEPENDABLE

The popularity of KINNEY Packaged Pumping Systems stems from the fact that they are so downright useful. They'll evacuate chambers, tanks, bell jars, furnaces, tubes or equipment—anywhere—and quickly. With main valve closed, the KINNEY PW-200 will attain ultimate pressures to 5×10^{-6} mm Hg with no coolant in the trap, (5×10^{-7} mm Hg with coolant).

The Rotatable "T" Manifold is a feature of KINNEY Packaged Pumping Systems. The stem of the "T" can be rotated a full 90°—from horizontal to vertical—so that the system is readily converted to form a complete Evaporator by the addition of a suitable baseplate. Get the facts on the PW-200 and other KINNEY Packaged Pumping Systems.

WRITE—
for your copy of Bulletin 4000.1. It's FREE.

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THE PIERCE-WALLER
AIR-LUBE
SYSTEM

CUTS COSTS for DIE-CASTERS

• CLEANS
• LUBRICATES

Remove loose flash and clean the mold with a powerful, clean air blast — then lubricate all mold surfaces evenly, *using the same gun* —with a flick of the thumb! Adjustment *at the gun* for full range from zero to a heavy mist, spraying, fogging, or vaporizing the lubricant. Speeds up mold operation and reduces casting rejects. Makes every machine cycle count.

USED IN LARGE AND SMALL SHOPS EVERYWHERE!

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BOOKS

THEORETICAL ELASTICITY AND PLASTICITY FOR ENGINEERS; Dr. D. E. Godfrey; Thames and Hudson, London, 1959. 311 pages. Price: $9.00.

This book is for the engineer who would like to build upon his knowledge of Strength of Materials with a more precise form of theoretical stress analysis.

Most engineers (excluding those in the aircraft industry) base their stress calculations on theory derived from the science of Strength of Materials. This approach uses assumptions to simplify calculations. These assumptions make the results approximations, but usually very close approximations, good enough for most engineering work.

However, if calculations must be very precise, the engineer can turn to Theoretical Elasticity, the mathematicians approach to stress analysis.

This comprehensive text on Theoretical Elasticity is suitable for personal study, with problems and fully explained solutions at the end of most chapters.

The more advanced mathematical principles used to develop theory are explained in an appendix.

HANDBOOK OF CHEMISTRY AND PHYSICS, 42nd EDITION; Charles D. Hodgman, Editor in Chief; The Chemical Rubber Publishing Co., Cleveland, Ohio 1960. 3400 pages. Price: $12.00.

This well-known, one-source reference covering mathematics, physics, and chemistry has just been up-dated for the 41st time. Obsolete information has been deleted, and other data has been revised where necessary.

The handbook is divided into five parts: Mathematical Tables, Properties and Physical Constants, General Chemical Tables, Heat and Hygrometry, and Quantities and Units.

New tables include Diffusion of Metals into Metals, Interplanetary Orbits, and Standard Types of Stainless Steel. The revised and expanded data includes Atomic Weights, Trade Names of Plastics, and Nuclear Spins.

ATTENTION
ALL DIE CASTERS!

• For advanced engineering in fully automated die casting machines...

• For lowest cost, production-proved automatic ladling for aluminum and vacuum die evacuation (Morton system)...

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REJECTS knocking your profits for a loop?

The alloys you're using may be at fault— For good casting results your alloys must fulfill a considerable number of specific requirements, PLUS all the particular qualities to meet YOUR casting needs.

See how HB&S start-to-finish quality controls guarantee alloys always 100% "on spec" . . . write TODAY for Henning's "Reference Book and Guide on Zamak (Zinc Base) Die Casting Alloys". It's yours for the asking.

YOUR CASTINGS CAN BE NO BETTER THAN THE ALLOYS YOU USE

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Smelters and Refiners of Aluminum, Bronze, Brass, Zinc, Lead

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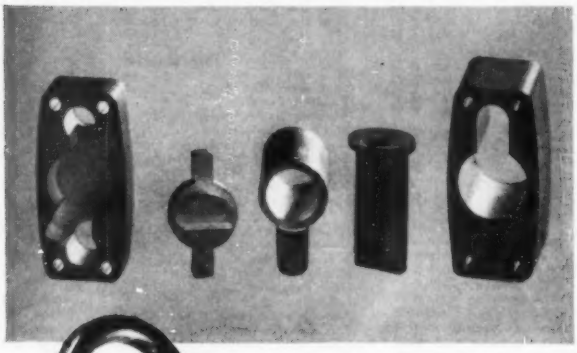

when DESIGNING for ...SECURITY ...DURABILITY ...ECONOMY

Made to military specifications by Reese Padlock Company, this new dead-bolt padlock is built almost entirely of brass powder parts.*

Designed to take full advantage of powder metallurgy economies

...Machining Operations Are Practically Eliminated
...Assembly Is Greatly Simplified
...Appearance of the Corrosion Resistant Brass Finish Is Further Enhanced By Scratch Brushing

Where SECURITY and DURABILITY with ECONOMY are needed in product assemblies, they can be easily achieved by specifying brass powder parts.

*by REMET, Lancaster, Penna.

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THE NEW JERSEY ZINC COMPANY
160 Front Street, New York 38, N.Y.

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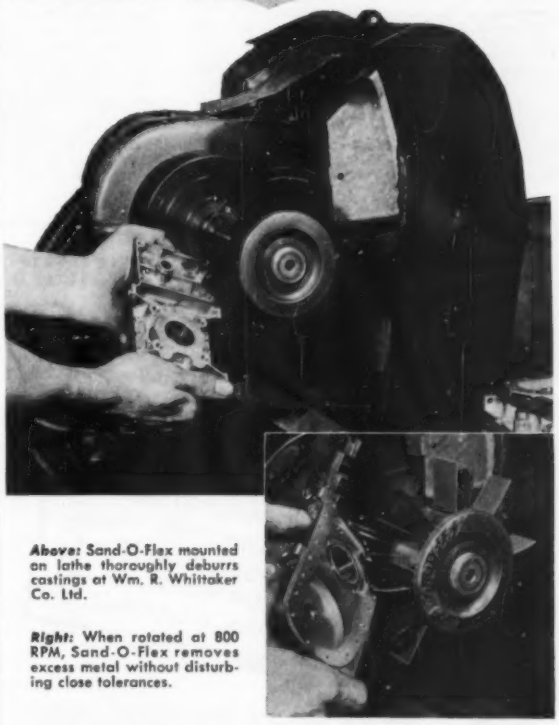
No other sander but SAND-O-FLEX can do this deburring job

Here Sand-O-Flex is solving one of the toughest sanding and deburring problems in the entire metalworking industry—removing burrs and slivers from intricate light metal castings without gouging the metal, chamfering straight edges or affecting close tolerances. These aluminum fuel slide valve housings for aircraft are thoroughly deburred in a matter of seconds at Wm. R. Whittaker Co., Los Angeles. Sand-O-Flex gets down-in and around the intricate shapes where no other sander can reach, yet still preserves the machined surfaces necessary for perfect alignment when assembled.



Above: **Sand-O-Flex mounted on lathe thoroughly deburrs castings at Wm. R. Whittaker Co. Ltd.**

Right: **When rotated at 800 RPM, Sand-O-Flex removes excess metal without disturbing close tolerances.**

Sand-O-Flex is saving money and man-hours in thousands of deburring and finishing operations around the world. As the sander spins, flexible brushes gently mold the abrasive cloth over irregular surfaces, "wiping off" excess metal. The abrasive unwinds from a cartridge inside the metal case and is fed out as needed. Abrasives are furnished in many grits for a wide variety of applications. Sand-O-Flex is an attachment—it fastens to any rotating spindle (motor, lathe, drill press, electric hand drill, etc.)—no special equipment necessary. Four models, from portable to heavy duty production line uses. Write for catalog and prices. If you have a tough finishing problem, tell us about it. Perhaps we can help you.

MERIT PRODUCTS, INC.
3691 Lenawee Ave., Los Angeles 16, Calif.

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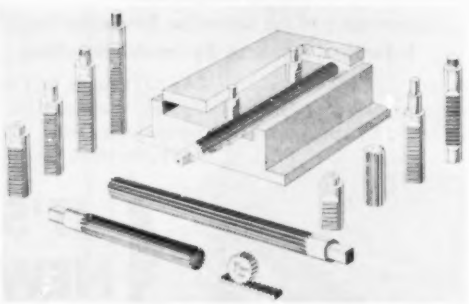

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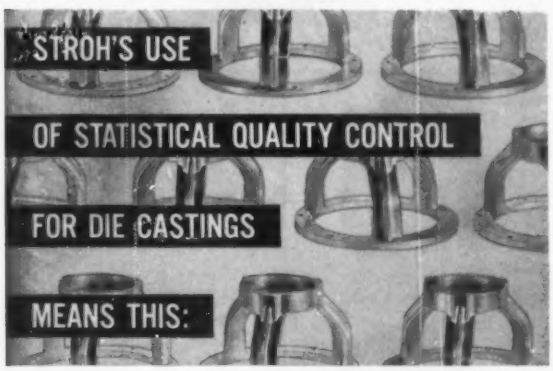

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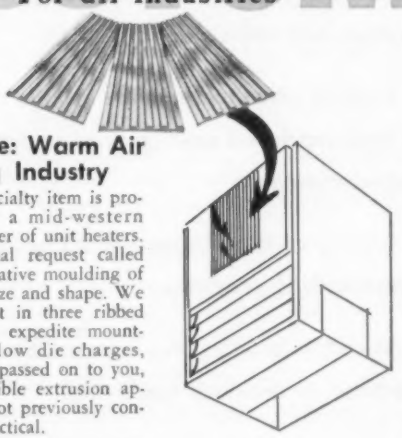

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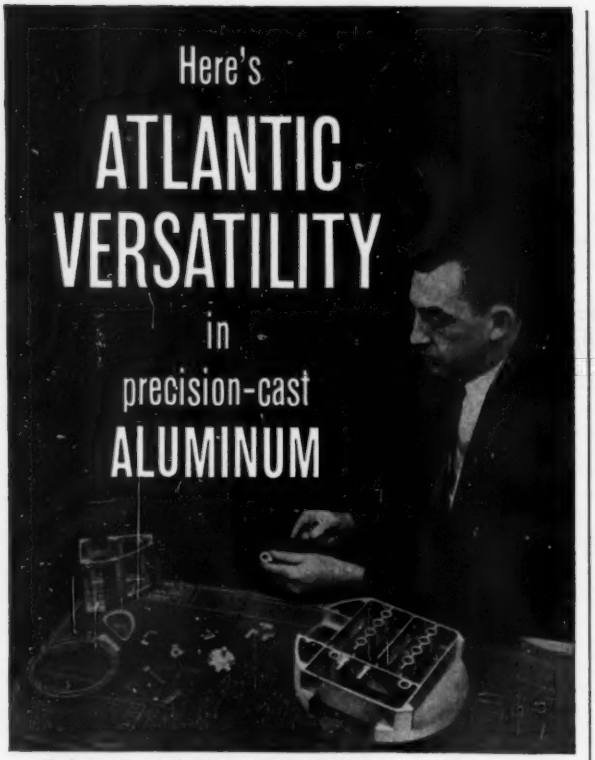

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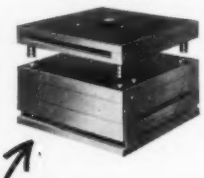

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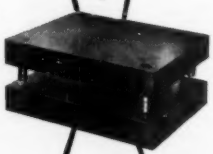

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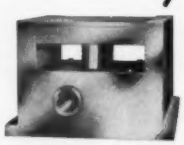

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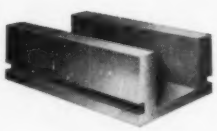

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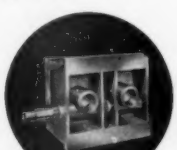

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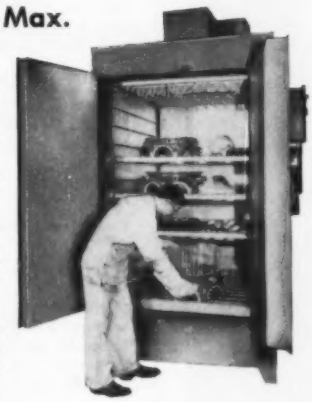

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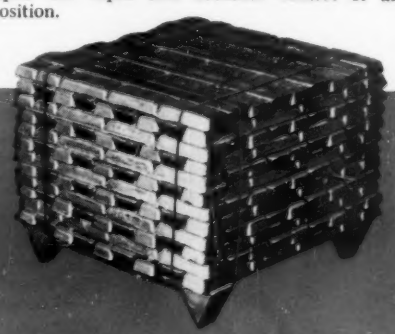

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